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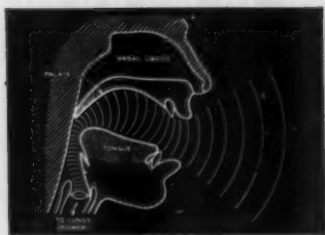
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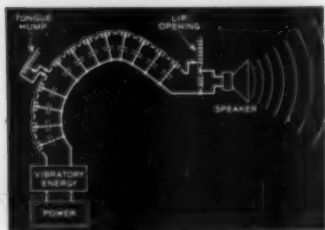
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## Antibiotic Growth Stimulants

**R**ESearch in nutrition has been dominated by vitamins for thirty years. This domination is by no means ended, but the time must come when the last vitamin will be apprehended, catalogued, civilized, and put to work. But there are promising new fields in nutrition. Antibiotics constitute one of them.

An antibiotic is a compound that is synthesized by one living organism and inhibits the growth of another. To speak of antibiotics as growth stimulants may therefore seem paradoxical. Inhibition of one member of an ecological community, however, may favor other members. Much of our knowledge of nutrition is based on studies of animals in cages, but even these animals have complex internal ecological relationships. Alteration of these relationships is probably the basis of the antibiotics' ability to stimulate growth of chickens, turkeys, pigs, and rats.

The feeding of an antibiotic does not change very much the total number of microorganisms in the digestive tract, but the inhibition of some species permits others to increase and take their places. Reports that dietary antibiotics decrease requirements for several vitamins and for protein could be explained either on the basis of suppression of nutrient-utilizing forms or on the basis of encouragement of nutrient-synthesizing forms. To make the explanation fit the facts, we must assume the existence of an unknown essential nutrient. The known nutrients are present in ample quantities in the best commercial feeds for growing chickens and turkeys. Yet growth rate is increased by adding suitable antibiotics to such diets. There probably are essential dietary factors still unknown, but thus far no mode of action is supported by anything but suggestive evidence. Inhibition of toxin-producing organisms may also be involved.

Antibiotics do not improve reproductive performance of chickens, and in the diet of ruminants they are detrimental rather than beneficial, presumably because of different internal ecology. Thus their usefulness in

the diet appears to be limited to growing non-ruminants.

The fact that feeding streptomycin with an experimental purified diet stimulated the growth of chickens was discovered at the University of Wisconsin in 1946. This work received little attention, and the growth-stimulating effect of antibiotics was rediscovered in 1950. Rediscovery was incidental to the development of vitamin B<sub>12</sub> concentrates from by-products of antibiotic manufacture. Some of these were more effective than others in stimulating growth, and this extra effect was traced to residual antibiotic.

Aureomycin, bacitracin, procaine, penicillin, and terramycin are being used commercially in feeds. Commercial broiler feeds are believed to contain antibiotics at levels ranging from two to seven grams per ton. If we assume an average of four grams per ton, the annual production of 3½ million tons of broiler feed requires 14,000 kilograms of antibiotic. Total production of aureomycin, penicillin, and terramycin in 1950 was about 300,000 kilograms. Of course, much of the aureomycin, bacitracin, and terramycin in animal feeds is residual and would not be recovered for other uses in any case. Each of them is also being used in pure or concentrated form to standardize the potencies of the residues for animal feeding. Penicillin differs from the others in the manner of its use. Practically all of it in feeds is crystalline procaine penicillin rather than residual material. There is little or no accumulation of antibiotic in the edible tissues of animals fed the above-mentioned levels.

Not all the consequences of this new development in nutrition can be foreseen, but some are already visible. These include the need to change or qualify the accepted figures for requirement of known nutrients, the need to re-evaluate the importance of microorganisms in the digestive tract of the nonruminant, and the opportunity to increase materially the efficiency of meat production.

H. R. BIRD

Bureau of Animal Industry, USDA  
Beltsville, Maryland

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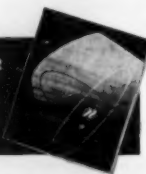
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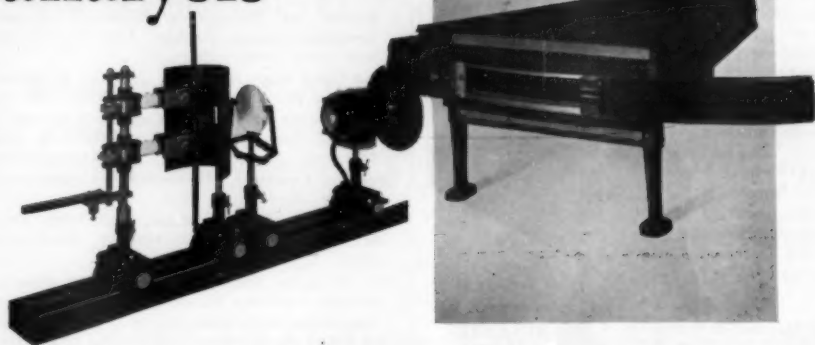
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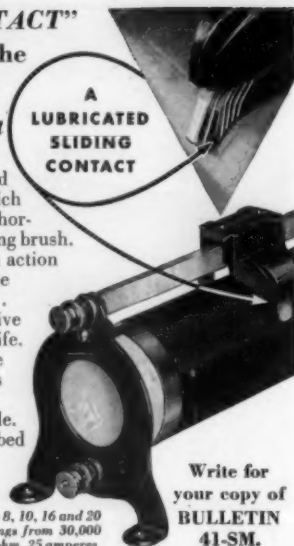
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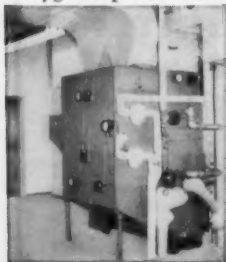
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IN DATING POSTGLACIAL ORGANIC REMAINS by measuring the radioactivity of residual carbon 14, there is an uncertainty about the probable composition of marl and caliche that must be kept in mind. To a less degree the same uncertainty may apply to peat subaqueously produced under conditions that approximate those under which marl may be deposited. Alternating layers of marl and peat are frequently produced in the same plant habitat, indicating an environment fluctuating through the narrow range of conditions that result, on one side, in precipitation of calcium as calcareous tufa or marl and, on the other, in deposition of calcareous (as opposed to fairly acid) peat. At the time of deposition an indeterminate amount (up to 50 per cent) of "dead"  $C^{12}$  derived from geologically ancient calcium carbonate may dilute the equilibrated mixture of  $C^{12}$  and  $C^{14}$  derived from atmospheric carbon dioxide.

In the formation of the marl beds and calcareous tufa deposits that overlie glacial till in the glaciated region, the available calcium was derived from more or less pulverized Paleozoic limestone and dolomite, in which radioactivity from  $C^{14}$  content would have approached extinction. Calcium carbonate containing only "dead" carbon, in contact with rain water saturated with atmospheric  $CO_2$ , would yield soluble calcium bicarbonate in which the  $C^{14}$  constituent could not exceed half that in atmospheric  $CO_2$ , because some amount less than half of all the carbon would initially have come from the ancient limestone and would be "dead." Escaping from a hillside spring, or seeping underground into a lake, pond, or river, the equilibrated system, water-carbon dioxide-carbonic acid-calcium bicarbonate, would yield  $CO_2$  to submersed plants carrying on photosynthesis. As a result of the disturbed equilibrium, calcium carbonate would be deposited in or on the plants, as, for example, in *Chara*, or on *Potamogeton*, or within the gelatinous matrix of certain blue-green algae, which act as agents in the formation of marl concretions.

Assuming that calcium bicarbonate produces calcium ions as well as hydrogen ions by dissociation, no matter in how low a concentration, then the constant make and break of ionizing molecules in an equilibrated system would yield a marl or calcareous tufa with more than half the  $C^{14}$  radioactivity that would be expected if the marl were actually of organic origin. The possible error that would arise from considering a marl or tufa to be of "organic" origin would correspond to less than the half-life of  $C^{14}$ . One cannot

assume full half, for dissolved atmospheric  $CO_2$  also enters into the soil-water equilibrium, and its resulting product, carbonic acid, regardless of how little there may be, dissociates and serves as a means of equilibrated exchange of  $C^{14}$  for  $C^{12}$ .

In order not to take too much for granted, it is planned to determine the  $C^{14}$  radioactivity of calcium carbonate derived from a synthetic bicarbonate made from "dead" calcium carbonate and atmospheric  $CO_2$  under conditions simulating those in nature. The results, however, can hardly fail to be in accordance with expectation. In the meantime, it will be well to take the precaution of eliminating calcium carbonate or other carbonates from "organic" materials to be dated by the radiocarbon method.

Superficial marls and calcareous tufas of post-glacial origin in the glaciated region cannot be expected to give dates that will conform with those derived from peat, charcoal, or undecomposed plant material of the same age. The age will appear to be greater than it actually is, and it would be expected that even peat formed subaqueously in water containing considerable calcium bicarbonate would yield dates of dubious authenticity. To the extent that  $CO_2$  used in photosynthesis is derived from the decomposition of dissolved calcium bicarbonate from limestone sources that are geologically old, it would be expected that aquatic plants would give rise to organic deposits deficient in radiocarbon, with the greatest possible deficiency always less than 50%. The actual deficiency would depend upon how much of the  $CO_2$  used in photosynthesis had been derived by direct diffusion from the air and not by the breakdown of calcium bicarbonate. The contemporaneous atmospheric constituent would probably be much greater, for even in ground water calcium bicarbonate would be enriched in radiocarbon by equilibration with radioactive  $CO_2$  directly from the air or produced by the respiration of animals and the underground parts of plants.

There are too many uncertain factors to make the dating of subaquatic calcareous deposits fully convincing. In order to appraise possible errors, the dating of peat with alternating marl or calcareous tufa must be undertaken. The only part of a calcareous sample used for dating in comparison with associated marl or tufa should be that part which is definitely organic (i.e., not a carbonate). This can best be secured by treatment of the mixed sample with hydrochloric acid, followed by thorough washing of the organic residue. The comparison of the carbonate and

organic components should be checked, if possible, by contemporaneous charcoal or wood from the same deposit.

It cannot be hastily assumed that wood or charcoal imbedded in a deposit is not actually either much older (charcoal) or much younger (wood) than the matrix. A wise precaution, therefore, in dating peat or organic material in archaeological deposits would consist in the mechanical sorting-out of possibly intrusive organic material. Thousands of years after an organic deposit had been initially laid down it could continue to be "diluted" and apparently made younger by new organic material introduced in the form of plant roots and burrowing animals. Among the least readily humified constituents of plant debris are pollen grains and leaf cuticles. Among the most readily humified under some conditions is wood. If the latter has been well preserved, however, it should be picked out. If too rotten for mechanical separation it may be removed, with other humified material, by acidification of the sample with dilute hydrochloric acid, washing by repeated decantation, treatment with ammonium hydroxide, and washing until all soluble humus has been removed. Washing the remaining detritus through a fine screen will permit detection of exuviae of insects and crustaceans, which may or may not be later and intrusive. If microscopic examination shows only cuticular debris with pollen and other spore exines, these, of all material in a deposit, are least likely to be intrusive and to be the best part for dating. Masses of wood from large tree roots may possibly be hundreds or thousands of years later than the peat in which they are imbedded, and if rotten are especially likely to dilute old material with young constituents. Intrusive organic materials from a recent surface might conceivably get into an old deposit by the filling of holes left by the rotting of dead trees, or by the activity of burrowing animals. The role of earthworms in turning over the soil is not to be forgotten, and the metabolic activities and final death underground of hundreds of thousands of generations of burrowing creatures may not be a negligible factor in radiocarbon dating.

The problem of determining the age of *caliche* deposits in arid regions poses great uncertainties. The redeposition of calcium carbonate from solution is more complicated in arid areas with strongly alkaline soils than in most of our northern glaciated regions, because the soil-water equilibria involve sodium carbonate and bicarbonate, as well as the two calcium carbonates, carbonic acid and carbon dioxide. Caution would lead one to use for dating no sample in an area of *caliche* from which carbonates had not been removed, and only constituents built as products of photosynthesis remained. Unless *caliche* were known from its geological relations to be so old as to be undatable by the radiocarbon method, there would be some question as to whether any carbon radioactivity detected in it might be wholly the result of

secondary enrichment by infiltration of old "dead" *caliche* with young bicarbonates. A desirable precaution in dating buried organic materials in regions where *caliche* forms is the removal of all carbonates by thorough acid extraction.

The problems of dating mollusk shells, eggshells, bone, and horn are varied. Specimens from dry caves may be unimpeachable; those that may have been subjected to replacements of original substance by carbonates from the soil solution may be extremely dubious material for dating. The possibility of replacement of original substance (such as phosphate) in shells by carbonate must be judged from the conditions of preservation. The original carbonate content of shells, precipitated from calcium compounds in body fluid by the shell gland, would doubtless at the time of deposition have the maximum radioactivity that would be expected from newly synthesized organic material. Later addition of carbonate might conceivably increase or decrease the  $C^{14}$  content, depending upon circumstances. The same is true for bone. Horn and ivory might have enough organic material left in them, even after burial, so that they could be decalcified for dependable dating.

The object of this article is to put enthusiasts for the radiocarbon dating of postglacial and prehistorical events on their guard against assuming that the method will have no gross sources of error quite independent of laboratory procedure in the measurement of radiation. Even charcoal from alkaline regions should be acid-treated and washed to remove carbonate. Marl should not carelessly be assumed to be of organic origin. It may be partly so, to the extent that it is made of shells, but the greater part of most marl is formed incidentally through the agency of submersed plants, which disturb a complex equilibrium by removal of  $CO_2$  used in photosynthesis and thus bring about precipitation of calcium carbonate from material that never entered into their biochemical structure. It has merely been chemically deposited, even if found in the sheaths or cell walls of algae. Except under thoroughly understood conditions, marl cannot be considered datable. Neither can *caliche*. Even peat found in close association with marl or calcareous tufa is somewhat doubtful and should be used with caution, after removal of carbonates and mechanical and chemical separation of possibly late intrusive organic constituents. The dating of peat in acid bogs is likely to be safe, if intrusive material is guarded against. Wood or charcoal found in marl or *caliche*, if decalcified, will be dependably datable, for its organic carbon will have come only from photosynthesis, but it need not be of the same age as the matrix. Precautions must be taken to detect possibilities not only of materials having had their carbon radioactivity diminished by entry of "dead" carbon, but also of having been enriched in radiocarbon content by physical and chemical processes that are constantly taking place.

# The Planning of Libraries for Military Research Establishments

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THE NEED FOR SCIENTIFIC AND TECHNICAL RESEARCH as an adjunct to military activity has long been recognized and implemented. The function of libraries as a vital part of this research is also well established. Less well established are the subtle differences that exist between libraries serving military and those serving nonmilitary research organizations. With the current acceleration of military research both within the government and through government-let contracts, the need for defining and recognizing these differences is becoming increasingly important.

*The function of libraries in military research.* Libraries may be defined, in general, as organized depositories for published information. In the case of libraries serving military research organizations three additional features must be added to make the definition complete. The first is expedience. Libraries serving military research organizations are required to render more extensive and more rapid service than is usually expected of other libraries. Accordingly, the military research library must be carefully arranged both physically and staffwise. Its layout must be such that the published information it contains can be made available on a moment's notice. The professional staff must be technically trained so as to be able to understand the problems at hand and to ferret out, with dispatch, the information necessary to solve them.

A second characteristic of military research libraries is their tone. Military research is usually conducted on a "task" basis, with definite products or goals in view. For this reason the libraries, as a rule, are "tight" collections, containing a minimum of purely scholarly material and concentrating on recent works that are directly related to the problems at hand.

The third feature that differentiates the military research library from the general run of libraries is security. In addition to books, periodicals, and pamphlets, the library contains specially prepared documents relating directly to the activities of the organization it serves. Many of these documents have security classifications, and hence cannot be circulated or stored in the usual manner.

Related to the matter of security is the fact that classified documents are not catalogued according to standard procedures. Thus, whereas the work of the average library cataloguer is simplified through the

use of printed Library of Congress catalogue cards, which analyze literature, suggest subject headings, and furnish complete bibliographic data, the cataloguer of classified material must do his own analyses, classifications, and abstracts.

There is at present a movement in this country to standardize the cataloguing and abstracting of classified literature. Representatives of the National Advisory Committee for Aeronautics, the Atomic Energy Commission, the Navy Research Section of the Library of Congress, and the Central Air Documents Office of the Air Materiel Command are considering methods for bringing about such a standardization. This Group for the Standardization of Information Services has developed a standardized printed card denoting the issuing agency, author, and title, and containing an abstract, with suggested subject headings for indexing and cataloguing.<sup>2</sup>

*Physical layout and costs.* There are two methods of handling the physical aspects of the security problem in establishing facilities for a military research organization. One possibility is to set up two distinct libraries, or types of libraries—one for fundamental research, containing all unclassified literature, and the other containing classified documents. One library would be physically separated from, and administratively independent of, the other. Each would have to be completely staffed and completely indexed. Many military research establishments maintain such a dual library setup.

A second possibility is the establishment of a physically and administratively combined classified and unclassified library, with special precautions to insure availability and circulation of classified materials to authorized personnel only. Recently there has been a trend toward this combined type of literature-handling operation.

The reason for the increasing preference for combined libraries is quite evident. Jorgensen and Carlson (1) estimate the basic cost of establishing a technical library serving a staff of 400 people to be \$47,500 for books, periodicals, equipment, and supplies, and \$25,000–\$30,000 for salaries, during the first year of operation. They estimate annual operating costs after the first year to be \$8,000 for books, periodicals, equipment, and supplies, and \$20,000 for salaries.

<sup>2</sup> A permanent agency, the Armed Services Technical Information Agency (ASTIA), has been proposed to perpetuate the work of the unofficial Group for the Standardization of Information Services.

<sup>1</sup> Operating under Contract NOrd 7386 with the Bureau of Ordnance, U. S. Navy.



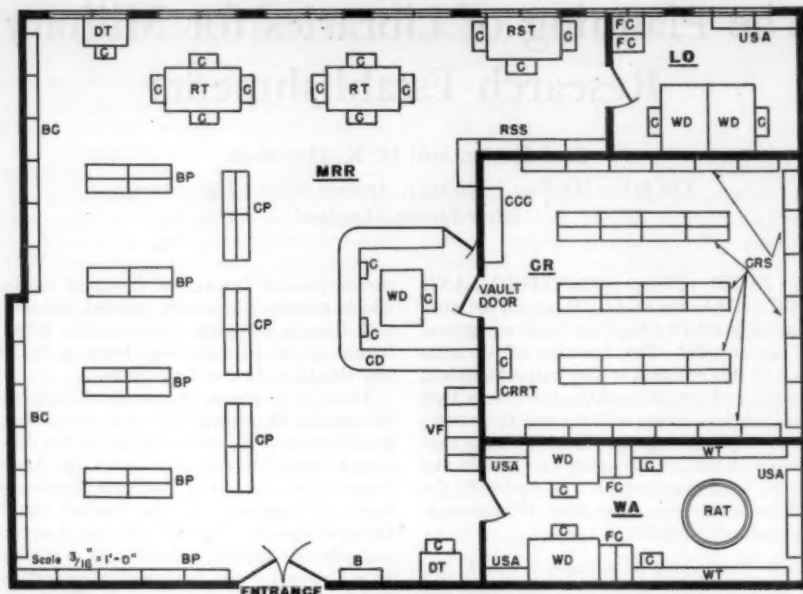


FIG. 1. A combined fundamental research and classified document library. Physical features are as follows: Browsing Collection (B); Book Collection (BC); Bound Periodical Collection (BP); Chairs (C); Card Catalogue (CG); Classified Card Catalogue (CCC); Charge Desk (CD); Current Periodical Collection (CP); Classified Reports Area (CR); Classified Reports Readers' Table (CRRT); Classified Reports Shelving (CRS); Dictionary Tables (DT); Filing Cabinets (FC); Librarian's Office (LO); Main Reading Room (MRR); Revolving Assembly Table (RAT); Reference Section (RSS); Reference Section Table (RST); Readers' Tables (RT); Utility Shelving Areas (USA); Vertical File (VF); Work Area (WA); Work Desks (WD); Work Tables (WT).

Eliminating \$41,500 (the estimated cost of books, bound periodicals, and current periodicals) from the basic investment, since most classified literature may be obtained without cost, there remains a required first-year expenditure of \$6,000 for equipment and supplies,<sup>3</sup> and \$25,000–\$30,000 for salaries. Eliminating \$7,500 (the cost of new books and yearly periodical subscriptions) from the annual operating costs, we have a total of \$25,500 a year needed to operate an independent document library. Thus a military research organization having a total staff of 400 people would be faced with an initial outlay of \$97,000–\$107,500 and an annual outlay of \$53,500 if it chose to maintain separate basic research and classified-document libraries.

Aside from the need for an additional, technically trained abstractor and cataloguer to assist in the slow and difficult process of indexing and abstracting new book, periodical, pamphlet, and classified-document acquisitions, it is entirely possible to operate a combined library of the approximate scope outlined above with the staff required to operate either a classified-document or a basic reference library. This would mean an annual saving of approximately \$15,000 in salaries alone.

#### A combined classified and unclassified library. The

<sup>3</sup> Current price increases in library equipment and supplies may raise this figure considerably.

illustrated floor plan<sup>4</sup> for a combined basic reference and classified document library (Fig. 1), based on a proposed solution to an actual library problem, is smaller in the scope of its book and periodical collections than the hypothetical library outlined above. Although intended to serve a scientific and technical staff of 300–400, the plan presupposes the proximity of larger, more complete technical reference libraries and a fairly heavy traffic in interlibrary loans. It also assumes a culling policy that will keep the size of the collection reasonably static, and a deposit library for the storage of culled materials. In the absence of adequate neighboring libraries, an active interlibrary loan program, or a culling policy, it would be necessary to enlarge the facilities proportionately.

The floor plan is designed for a collection of 3,100 books, 2,400 bound periodicals, 250 current periodical subscriptions, 2,160 pamphlets, and 57,000 classified documents, with space for approximately 15 readers. Standard library shelving is used for both the classified literature in the vault (CR) and the unclassified collection in the main reading room (MRR). Besides being neater, the storage of documents on shelves rather than in file cabinets has the double advantage of allowing large numbers of items (approximately 65–80 per linear foot) to be accommodated in a com-

<sup>4</sup> The authors are indebted to Doris Rubenfeld, who prepared the plan.



paratively small floor area and, at the same time, of diffusing the floor load. Pamphlets, special bibliographies, tear sheets, etc., are kept in a vertical file, which consists of five four-drawer file cabinets.

The plan also includes an area (WA) for the assembling and distribution of classified documents produced by the organization served by the library. This fundamental publishing activity is fairly common among military research establishments, but it is not an intrinsic part of library activity and might well be made a function of another division of the organization, such as the mailing department.

The estimated initial costs of implementing a library of the size and scope projected are as follows: Books, bound periodicals, and current periodical subscriptions, \$41,375; equipment, furniture, and supplies, \$9,956; salaries, \$27,550. After the first year, operating expenses would be: New books (500 at \$5.00), \$2,500; periodical subscriptions (250 at \$7.50), \$1,875; binding (300 volumes at \$3.00), \$900; supplies, \$750; salaries, \$23,550.

**Staff requirements.** Initially, the staff requirements of the combined library would be as follows:

- 1) A *chief librarian* to administer the whole operation, determine policy, select new acquisitions, and to initiate and supervise literature searches as they are required.
- 2) An *assistant chief librarian* to administer the business operations of the library, assist in the supervision of the library and its related document-assembling and distribution activity, and to perform literature searches.
- 3, 4) Two *cataloguer-abstracters*.
- 5) A *desk attendant* to supervise circulation of the classified and unclassified collections, maintain circulation records, and to answer simple reference questions.
- 6) A *clerk-typist* to assist the cataloguer-abstracters, and

to order and type catalog cards and process books and reports.

- 7) A second *clerk-typist* to furnish general clerical and stenographic assistance to the professional staff of the library.

- 8, 9) Two *clerks* to assemble and distribute classified documents and to render general assistance.

At the end of the first year it would probably be possible to operate the library with one less cataloguer-abstracter and one less clerk. In a library operation of this size, interchangeability of personnel is a primary prerequisite. All must be adaptable and thoroughly familiar with the day-to-day activities of the group.

**General considerations.** In addition to the monetary considerations discussed above, there are two factors to be weighed in deciding on the advisability of a unified library as opposed to separate classified and unclassified libraries. Often, in searching the literature for technical information, it is difficult to predict whether this information will be classified or unclassified. The presence of both collections in a single area, manned by a single staff acquainted with both, makes for a much simpler and more efficient situation than exists where there are two libraries with two staffs in two different parts of the research establishment. On the other hand, in large organizations, where military research is but a minor part of the total activity, the two-library setup is definitely indicated, because only a part of the total staff will have the security clearance necessary to see and use the information contained in classified documents.

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## Technical Papers

### Technetium in the Sun<sup>1</sup>

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A sufficient quantity of element 43, technetium, has been isolated at Oak Ridge National Laboratory to permit the observation of the first and second spectra of this rare element. The description of these spectra has recently been published by Meggers and Scribner (1). It is therefore possible to remove this element

<sup>1</sup> The inspiration for this note has come from W. F. Meggers, who generously furnished in advance of publication his manuscripts containing both the description and preliminary analyses of the Tc spectra. H. N. Russell has also taken a keen interest in this question, and estimated a reasonable value of the half-life of a long-lived isotope of Tc. The writer is greatly indebted to both for their very helpful suggestions and cordial collaboration.

from the category "Insufficient Laboratory Data" for identification in the sun (2), and to search for the leading lines in the solar spectrum.

In the Tc I spectrum there are three conspicuous low level lines that should be present if this element is represented in the solar spectrum. The *raie ultime* is masked, and the other two lines are absent. Because all strong lines of Tc are widened by hyperfine structure, concentrations less than  $10^{-7}$  cannot be detected spectroscopically. The data for the leading lines are given in Table 1. The laboratory material is arranged in the form adopted by the writer in her *Multiplet Tables* (3). If Tc I is present, it is extremely faint—too weak to be detected spectroscopically in view of the unquestionable presence of Cr I at 4297.050 Å, which masks the *raie ultime*.

By analogy with related elements in the periodic

TABLE 1  
COMPARISON OF STRONG TC I LINES WITH SOLAR LINES

Laboratory*					Sun†			
I A	Intensity arc	Low EP	J	Multiplet designation	I A	Intensity disk spot	$\Delta\lambda$ - Lab	Solar identification
4297.06‡	500c§	0.00	2½-3½	a°S-x°P°	.045	1 2	-.01	Cr I
4262.26	400c	.00	2½-2½		Absent or masked‡			
4238.19	300c	.00	2½-1½		" " " "			
4031.63	300c	.32	4½-4½	a°D-x°D°	" " " "			
3636.10	400c	.32	4½-5½	a°D-x°F°	" " " "			
3466.29	250c	0.32	4½-3½	a°D-x°P°	.285	0	-.01	Fe I

\* Analysis from material by W. F. Meggers, *J. Research Natl. Bur. Standards*, **47**, 7, RP 2221 (1951).  
 † For solar data, see C. E. St. John et al., *Carnegie Inst. Washington Pub. 396, Papers Mt. Wilson Observ.*, Vol. III (1928). The solar wavelengths have been corrected as indicated by H. D. Babcock, C. E. Moore, and M. F. Coffeen, *Astrophys. J.*, **107**, 287; *Contribs. Mt. Wilson Observ. No. 745* (1948).  
 ‡ *Rare* *ultime* by analogy with Mn I.  
 § H. D. Babcock (letter, December 1950) states that no line of the expected intensity is discernible on the solar atlas, because of the surroundings.  
 ¶ In laboratory intensity column, c denotes that the line is complex. See K. G. Kessler and W. F. Meggers, *Phys. Rev.*, **80**, 905 L (1950).

table, technetium might be expected to appear in the singly ionized state. In the Te II spectrum there are six outstanding low-level lines. The three strongest, each of which has an estimated spark intensity of 600 or more, lie at 2543 Å, 2610 Å, and 2647 Å—a region where the solar spectrum is unknown, excepting rocket spectra of very low dispersion which do not permit a test, since all observed solar lines are badly blended. Of the remaining three, the one at 3212 Å is masked by Fe I; and one at 3237 Å, if present, is blended with Co I in the sun. The third, at 3195 Å, agrees well with an unidentified solar line of intensity -1 on Rowland's scale of estimates. The data are given in Table 2, together with those for three fainter lines.

The Co I line at 3237.028 Å is not sufficiently strong in the laboratory spectrum to account entirely for a solar line of intensity 1, but is doubtless one of the

leading contributors. The Fe I line at 3211.989 Å would have a solar intensity of at least 2, and must mask any other candidate. The evidence for the presence of Te II in the sun rests chiefly, therefore, on the one unblended solar line at 3195.230 Å, a line that has heretofore remained unidentified. A faint laboratory line of Mo II exists at 3195.233 Å, but, by comparison with the solar intensities of the strong lines of Mo II, it may be ruled out as too faint to appear in the sun. Similarly, the weaker lines of Te II given in Table 2 cannot be present unless the line at 3195.21 Å is present.

For an element known to exist in nature in any appreciable amount, the above evidence would indicate the possibility of its presence in the sun, among the least abundant elements. The three leading lines of Te II in the accessible region of the solar spectrum are all accounted for, none appearing to be definitely

TABLE 2  
COMPARISON OF STRONG TC II LINES WITH SOLAR LINES

Laboratory*					Sun†			
I A	Intensity		Low EP	J	Multiplet designation	I A	Intensity disk	$\Delta\lambda$ - Lab
	Are	Spark						
3237.02	200c‡	400c‡	1.0 ±	2-3	a°S-x°P°	.037	1	+.02
3212.01	80c	300c	1.0 ±	2-2		.005	2	.00
3195.21	50c	200c	1.0 ±	2-1		.230	-1‡	+.02
3298.85	15	60				.868‡	-3	+.02
3266.92	15	80				.950	1	+.03
2964.50	20	60				.52	0	+.02

\* Analysis from material by W. F. Meggers, *J. Research Natl. Bur. Standards*, **47**, 7, RP 2221 (1951).  
 † For solar data, see C. E. St. John et al., *Carnegie Inst. Washington Pub. 396, Papers Mt. Wilson Observ.*, Vol. III (1928). The solar wavelengths have been corrected as indicated by H. D. Babcock, C. E. Moore, and M. F. Coffeen, *Astrophys. J.*, **107**, 287; *Contribs. Mt. Wilson Observ. No. 745* (1948).  
 ‡ H. D. Babcock (letter, December 1950) reports that the line at 3195.230 Å is stronger than -1 in intensity, and that 3298.868 Å cannot be seen on superior Mount Wilson photographs of the solar spectrum.  
 § In laboratory intensity column, c denotes that the line is complex. See K. G. Kessler and W. F. Meggers, *Phys. Rev.*, **80**, 905 L (1950).

absent. Accidental coincidences between laboratory and solar wavelengths can easily lead to spurious identifications, but if technetium exists in nature, the identifications tentatively suggested in Table 2 do not seem unreasonable.

The longest-lived Tc isotope known to date has a very short half-life, so far as elements found in the sun are concerned. The half-life of  $^{90}\text{Tc}$  produced at Oak Ridge National Laboratory by irradiating Mo with neutrons is  $9.4 \times 10^5$  years (4). A later determination from the Argonne National Laboratory is  $2.12 \times 10^5$  years (5). If a longer-lived isotope having a half-life of the order of  $4 \times 10^8$  years or more does not exist in nature, the suggested solar identifications are subject to serious doubt. The possibility that Mo can be transmuted into Tc in the sun is an interesting speculation. Lines of Mo I and Mo II are known to be present, although not conspicuous, in the solar spectrum. These considerations raise the interesting question as to whether Tc is as rare in the earth's crust as has been previously supposed. It appears that the possibility is not ruled out that the half-life of  $^{97}\text{Tc}$  or  $^{98}\text{Tc}$  may exceed  $10^8$  years (6).

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## A Simple, Inexpensive Microhomogenizer

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Quantitative assays of enzyme activity in tissue homogenates require that the respective homogenates be uniform as to completeness of cell lysis. The ordinary Pyrex glass homogenizer, consisting of an outer tube and a fitted, motor-driven pestle, has proved unsatisfactory in this respect in micro-analytical experiments involving many separate homogenizations. This is due primarily to the fact that the closely ground surfaces rapidly wear away, increasing the clearance and rendering the shearing action progressively less efficient. When one deals with minute amounts of tissue, these differences in the degree of cellular disintegration, however slight, may be quite significant, inasmuch as they are reflected as relatively large differences in enzyme activity, when the latter are projected against the small weights of the tissue assayed. The problem is more acute, of course, with tissues such as prostate, muscle, and

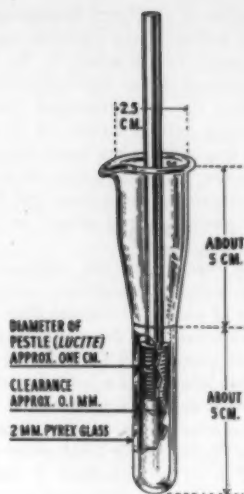


FIG. 1.

uterus than with more friable cellular tissues like liver, kidney, or spleen. Nevertheless, even in the latter variety, wear becomes an important factor when many homogenizations have to be done.

Early in 1948 efforts were made to develop a micro-homogenizer, to be used primarily for enzyme studies on rodent prostate.<sup>1</sup> Several varieties of all-Pyrex apparatus were either purchased or constructed in the laboratory, but all proved unsatisfactory because of rapid wear of the shearing surfaces after 10-20 homogenizations. Also, as has been pointed out elsewhere (1), the presence of powdered glass in the homogenates prevented the use of dry weights for reference. A homogenizer was finally constructed of a glass homogenizing chamber and a Lucite pestle (Fig. 1).

A thick-walled (2-mm) Pyrex test tube is used, approximately 10 cm long, with an inside diameter of 1 cm. The upper 5 cm are cut away and replaced by a glass cup 5 cm in length, which is fashioned from a Pyrex test tube measuring 2.5 cm in diameter. The pestle is made from 1/2-in. Lucite stock. It is easily machined to fit snugly into the test tube and measures 4.5-5.0 cm in length. The upper end is threaded onto a 6-mm aluminum rod about 12 cm long. The pestle is then ground into its final form with fine carborundum powder, using a slow stirring motor. The grinding is judged satisfactory when the dry tube drops slowly off the stationary pestle, indicating a clearance of about 0.1 mm.

The original homogenizer has been in active use since its construction three years ago. There has been no apparent change in the amount of clearance between the shearing surfaces or in the efficiency of homogenization. This is in marked contrast to the

<sup>1</sup> The author wishes to express his thanks to Charles Tesar and A. G. Morrow, of the Johns Hopkins Hospital, for their help in this work.

rapid deterioration of all-Pyrex homogenizers because of the abrasive action of the surfaces on each other. The original pestle was designed in the manner described above because it was anticipated that it would wear away while the tube remained intact; it was therefore threaded onto a metal rod from which it could easily be unscrewed when worn, and replaced by an identical pestle. In actual fact, however, it has demonstrated surprising endurance, and there is thus no reason why pestle and rod cannot be machined in one piece from Lucite.

Homogenates made with the original apparatus have remained uniformly acellular, microscopically. Reproducibility of assays of enzyme activity has been excellent. The time required for complete homogenization is somewhat longer than that of a new, all-Pyrex homogenizer, but it remains approximately constant, whereas the latter suffers a progressive loss of efficiency. For cellular tissues like liver, complete homogenization of 100 mg in 2 ml water at 500 rpm can be effected in 15 sec; prostate or uterus require 40-45 sec. In our work we have used wet weights for reference most often, but there is no objection to the use of dry weights in view of the absence of formation of powdered glass.

The homogenizer is ideally suited for minute amounts of tissue, such as cell colonies growing in culture. Here, where tissue weights are impracticable to measure, we have referred our results to mg total nitrogen.

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## Autoxidation in Lactating Mammary Gland Tissue<sup>1</sup>

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In the course of study of fatty acid oxidase in lactating guinea pig mammary gland tissue a phenomenon has arisen similar to the oxidative system described by Ellman and McLaren (1) for frozen poultry adipose tissue and erroneously called lipoxidase. The system described by Munoz and Leloir (2) and Lehninger (3) for liver, and by Grafflin and Green (4) for kidney, which oxidizes fatty acids, cannot be demonstrated to be in operation in mammary gland tissue under the conditions used by these investigators when fumarate or malate is added as the "sparking" cooxidant. However, if such a system is allowed to incubate for several hours (4-8 for various tissue preparations) at 37.5° C, a period of rapid oxidation is initiated, which continues at a steady rate

<sup>1</sup> This study was supported in part by a grant from the Robert Gould Foundation, Inc., Cincinnati, Ohio.

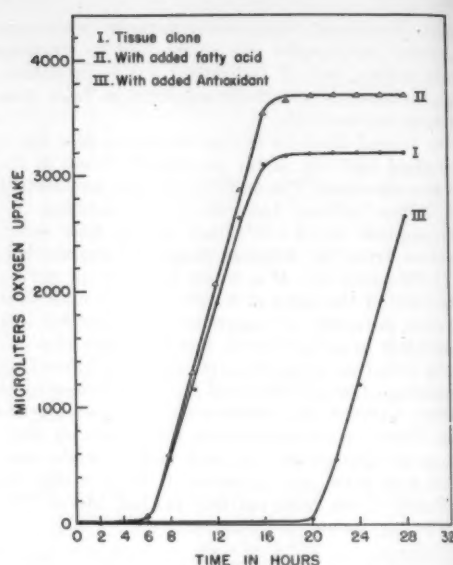


FIG. 1. The system contained the following in final concentration: 1.0% tissue homogenate, 0.002 M  $MgSO_4$ , 0.001 M Na ATP, 0.01 M phosphate buffer, pH 7.4; also, some flasks contained 1.5  $\mu M$  fatty acid (octanoate, laurate, palmitate, or stearate as the sodium salt); others contained an antioxidant (pyrogallol, hydroquinone, or thymol) in a final concentration of 0.001 M. Water was added to make a final volume of 3 ml.

for an additional 10-12 hr. The later phases of this oxidation are prolonged and intensified by the addition of numerous fatty acids. A definite similarity can thus be noted between this oxidative system in mammary gland tissue and that of Ellman and McLaren in adipose tissue. This is not surprising in view of the relatively large fat-tissue content of the mamma.

In the opinion of the authors the oxidative capacity of these tissue preparations does not indicate an enzymatically controlled oxidation and especially not the fatty acid oxidase system. Fatty acid oxidase has been demonstrated by numerous investigators (2-4) to be a very labile enzyme system which will not withstand freezing and thawing, storage, or long-time incubation. Also, these authors and others (5) have shown that to demonstrate the presence of a fatty acid oxidase, tissue preparations must be prepared in an isotonic medium and provided with some member of the citric acid cycle as a "sparking" reaction. None of these criteria was fulfilled by the system of Ellman and McLaren.

The question then arises as to the proper interpretation of this oxidation observed in adipose tissue (1) and mammary gland tissue. There is ample evidence from this laboratory to indicate that the reaction is simply autoxidation. Using standard Warburg procedures and mammary gland tissue homogenates, and measuring the oxygen uptake continuously for 22-30 hr, the curve shown in Fig. 1 was obtained. The kinetics of this curve correspond closely to those

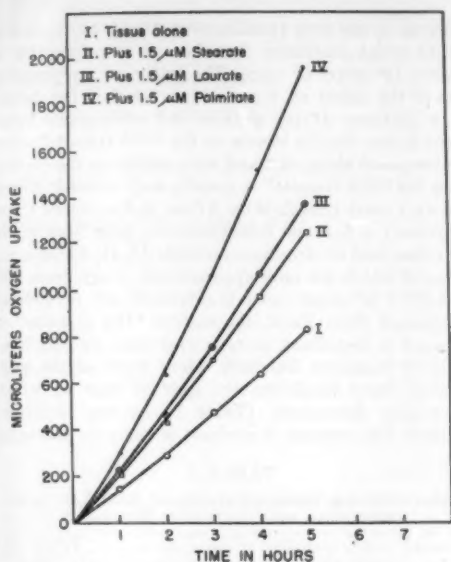


FIG. 2. The system was similar to that of Fig. 1 except that the tissue preparation had been autoclaved. The "zero" reading was taken after a 20-hr induction period.

usually associated with autooxidation of unsaturated fatty acids. It will be observed that the induction period is increased by compounds (pyrogallol, hydroquinone, and thymol) known to be antioxidants for an autooxidizing system. By determining bacterial contamination on agar plates at various times during the incubation, we have shown that the increased oxygen uptake at 4–8 hr is not due to bacterial growth.

The oxidation illustrated in Fig. 1 has been conclusively shown not to be enzymatic, since it is possible to repeat this curve in nearly exact duplication on a tissue preparation that had been autoclaved for 15 min at 15 lbs pressure. This also rules out the possibility that a new compound is being enzymatically formed during the induction period, which might then be rapidly oxidized during the later stages of the experiment. Even with this autoclaved preparation, the addition of fatty acids (1.5 μM octanoate, laurate, stearate, or palmitate) will increase the extent of autooxidation during its terminal phases. If the autoclaved system is allowed to incubate in the Warburg flasks at 37.5° C for 20 hr before shaking is begun and manometer readings are taken, the data shown in Fig. 2 are obtained. This figure corresponds closely to that in the report by Ellman and McLaren. The extent of oxygen uptake is substantially greater than that usually considered as being due to respiratory enzyme systems in equivalent tissue preparations. Additional experiments have shown that the oxidation does not require the presence of ATP or magnesium ions, as does the fatty acid oxidase system.

The fact observed here (as well as by Ellman and McLaren) that fatty acids increase the oxygen con-

sumption of this system cannot therefore be interpreted as being due to a fatty acid oxidase, but must be considered as affecting the extent of autooxidation of the system. The mechanism by which added fatty acids increase the extent of autooxidation is not known; however, one might speculate that a mutual solubility effect with the unsaturated constituents is brought about, thus placing these unsaturated components in a more favorable position for autooxidation.

In conclusion, we should like to point out that the oxidation observed in lactating mammary gland tissue is due to autooxidation and not to a fatty acid oxidase, and that observed in frozen poultry fat (1) appears to be of the same type.

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#### Concerning Orthography of Scientific Names

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Pierre Bonnet (France) proposed quite recently (1) that the following paragraph should be added to the Appendix to the *International Rules of Zoological Nomenclature*:

Paragraph "F" entitled "Transcription of the Roman v and i:" "The letters v and i become u and l before a consonant, and v and/or j before a vowel. Examples: urbs, ventus, illustris, imperialis (in the former event); dives, ventus, Jugum, Jacundis (in the latter case)."

First, some inexactness in the above proposal must be mentioned. Should the letters v and i become respectively, v and j before a vowel (sic!), then the words imperialis (quoted as an example, *ut supra*), Equus, conspicuus, tenuis, etc., are to be written imperialis, Equus, conspicuus, tenuis, etc. This is surely not intended by the author of the proposal. Accordingly, the dicta "before a consonant" (I) and "before a vowel" (II) are to be completed as follows: "Before a consonant and, in addition, before a vowel at the ending of a syllable" (I); "before a vowel at the beginning of a syllable" (II).

Unfortunately, these amendments of the original dicta of Professor Bonnet cause serious trouble if we consider the transcription of Greek diphthongs like αι, ει, οι, υι, αυ, ευ, followed by a vowel. How are names such as Aglaia, Αγλαία, Meoneurites, Μεωνευριτης, Oiorhinus, Οϊορρινός, Euonymus, Ευωνυμος, Evetria, Εβερτρία to be spelled in that case? The philologically correct spellings of these names would be: Aglaea, Meoneurites (better than Mioneurites), Ocorhinus, Euonymus, and Euetria.

According to Art. 70 of the *International Rules of*

<sup>1</sup> The original text in French put here into English.



*Botanical Nomenclature* and Art. 19 of the *International Rules of Zoological Nomenclature*, the original spelling of a name must be retained, except in the case of a typographic error or of a clearly unintentional orthographic error (error of transcription, a *lapsus calami*). When this rule is applied to the above-mentioned examples, we find it necessary to use the original forms *Aglaia*, *Meionurites*, *Oiorhinus*, *Euonymus*, *Evetria*.

It may be proposed, however, to authors of new names that, owing to the requirement of euphony, the following suggestions should be regarded in the future:

1. The diphthong *ei* be transliterated before a vowel as *e*, and before a consonant as *i*.
2. The diphthongs *ai* and *oi* be still transliterated as *ae* and *oe*, respectively.
3. The diphthong *vi* be transliterated as *yi*, e.g., *εργυρά*, *orgyla*, *μυτα*, *myta*.
4. The diphthong *av* be transliterated before a vowel as *av*, and before a consonant as *au*.
5. The diphthong *ev* be transliterated before a vowel as *ev*, and before a consonant as *eu*, e.g., *εὐεργετος*, *evuretus*.
6. The diphthong *ou* be still transliterated as *u* (contrary to a proposal by Höfker followed by Valckenier Suringar [2]).

The question of writing the simple letters *v* (*u*) and *i* (*j*) being of a typographic rather than an orthographic nature, we may use the rules of transcription both prospectively and retrospectively, provided that a proposal for the amended version of the respective paragraphs is accepted. Such minor additions to the *Codes* would bring the official biological nomenclature in greater compliance with practice.

On the other hand, some rules of the transliteration of Greek diphthongs cannot have any power to change the original orthography of names, and may only be considered as being a prospective but nonretroactive recommendation.

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### Probable Extreme Age of Pegmatites from Southern Rhodesia<sup>1</sup>

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The relative ages of the granite intrusives which, by and large, comprise the vast basement shield areas of the earth's crust, have been a cause for much investigation. The history of these basement-complex plutonics is extensive, and batholithic intrusion may extend over a period of as much as  $1,000 \times 10^6$  years. For example, in North America, many of the younger masses have ages of about  $700\text{--}1,000 \times 10^6$  years,

<sup>1</sup>This investigation is part of a general program of spectrographic research, carried on in the Department of Geology, MIT, under contract with the Office of Naval Research, Washington, D. C.

whereas in one area (southeastern Manitoba) evidence (1,2) seems conclusive that the age of pegmatites is  $2,000 \times 10^6$  years or more. The latter area represents one of the oldest on the earth's crust thus far dated.

In southern Africa, granite and orthogneiss basement rocks—locally known as the "Old Granite"—are well exposed along east and west coasts; in the central area the "Old Granite" is usually well covered. Along the west coast (South-West Africa and northern Cape Province) a few age determinations have been made by either lead or strontium methods (3,4). These ages, some of which are only approximate, range from 700 to  $1,100 \times 10^6$  years; none is extremely old. Stretching northward from Natal, the eastern "Old Granite" is exposed in Swaziland, eastern Transvaal, and particularly in Southern Rhodesia. Here some of the pegmatites carry lepidolite, the ages of nine of which have been determined (Table 1) by the strontium method. The method of analysis is basically the same

TABLE 1  
STRONTIUM AGE DETERMINATIONS ON NINE LEPIDOLITE SPECIMENS FROM SOUTHERN RHODESIA\*

Location	Years ( $\times 10^6$ )
1 Pope Tantalum Mine, 11 miles east of Salisbury (Large mauve flakes)	2,000 1,900 2,500 2,100 2,350
Mean	$2,150 \pm 200$
2 15 miles NNE of Salisbury (Pale, compact)	2,300 2,200 1,750 2,700 2,200
Mean	$2,200 \pm 200$
3 Lutope Tin Mine, Wankie District (Deep-purple, medium-grained)	2,050 2,100 2,200 2,100 2,100
Mean	$2,100 \pm 200$
4 Odzi District (Light-mauve, medium-grained)	2,000 2,000 1,950 2,450 1,950
Mean	$2,100 \pm 200$
5 Antelope Mine (Massive, purple)	2,100 1,900 1,750 1,900 1,700
Mean	$1,900 \pm 200$
6 South of Al Hayat Claims, Bikita Kop, Bikita District (Pale, fine-grained)	2,300 2,200 1,700 2,400
Mean	$2,150 \pm 200$

Location	Years ( $\times 10^6$ )
7 Mauve Kop, near Fort Victoria, Bikita District (Deep-purple, medium-grained)	3,100 3,300 2,900 3,100
Mean	$2,950 \pm 300$
8 Nigel Claims, N of Al Hayat Mine, Bikita District (Purple, columnar)	2,100 2,100 2,000 2,200 1,800
Mean	$2,050 \pm 200$
9 Al Hayat Mine, Bikita District (White lepidolite)	3,000† 2,350 2,200 2,500 2,350
Mean	$2,300 \pm 200$

\* All measurements calibrated in terms of a standard lepidolite from southeastern Manitoba, the age of which has been taken as  $2,200 \times 10^6$  years.  $2,200 \times 10^6$  years = mean of lead and strontium ages. Analysts: M. Davidson and L. Ahrens.  
† This result omitted from calculation of mean.

as described by Ahrens (4) but has been modified and improved by M. Davidson in the Cabot Spectrographic Laboratory, MIT.

The mean value for each specimen is given in Table 2. With the exception of No. 7, all means fall within the range  $1,900-2,300 \times 10^6$  years, which gives a mean for all specimens of  $2,100 \times 10^6$  years.

TABLE 2  
(Mean Ages from Table 1)

No.	Age (years $\times 10^6 \pm 200$ )
1	2,150
2	2,200
3	2,100
4	2,100
5	1,900
6	2,150
7	$2,950^* \pm 300$
8	2,050
9	2,300
Mean	2,100

\* This result excluded from calculation of mean.

Seen as a whole, the nine ages indicate with a high degree of probability that the area of basement intrusives covered by these lepidolite specimens is extremely old and is comparable in age with the basement granite exposure in southeastern Manitoba. This makes at least two areas on the earth's crust that have an age of about  $2,000 \times 10^6$  years, or perhaps a little more. A third possible area of like magnitude in age is that of the granites and associated pegmatites at Varuträsk, Sweden (an age investigation on this area is still in progress). A fourth region of great age, but possibly a little younger, is that of northern Karelia, Russia.

July 20, 1951

Field evidence in Southern Rhodesia, as elsewhere, on the basement intrusives shows that phases of massive igneous emplacement were fairly numerous, and the fact that eight of the above ages are in good agreement (within  $\pm 200 \times 10^6$  years of the mean) does not necessarily mean that they belong to the same phase of activity. They evidently all belong to the same major cycle of orogenic events. The analytical error on each specimen is about 10% ( $\pm 200 \times 10^6$  years at  $2,000 \times 10^6$  years) and gives some latitude for more than one phase of activity. Taken as a whole, the area is approximately twice as old as the basement plutonics along the west coast.

A chief criticism that may be leveled at the validity of the age determinations given here is that no isotope analyses have been made. Although such an analysis is always desirable, there seems little doubt that the strontium in the Rhodesian specimens is largely radiogenic. This is based for the most part on reasons given (2) in the discussion of lepidolite ages from Manitoba and on the following short discussion on calcium.

Strontium is commonly associated with calcium, and the concentration of this common element serves as a useful, though rough, indicator of the possible presence of ordinary strontium. Table 3 gives some approximate calcium concentrations. With the exception of No. 9 (0.07% Ca), calcium is relatively low (0.006-0.015%) and is typical of the amounts frequently found in lepidolite. The measured age of No. 9 (Table 1) appears slightly greater than any of the other accepted ages and could conceivably be due to the presence of a little common strontium.

TABLE 3  
APPROXIMATE CALCIUM CONCENTRATION IN SOUTHERN RHODESIAN LEPIDOLITE

No.	% Ca
1	0.006
2	.007
3	.01
4	.015
5	.006
6	.012
7	.01
8	.01
9	0.07

Considering the great age of these specimens, a fairly high proportion of this calcium (up to 40% in some) is likely to be radiogenic; that is, formed by  $\beta$ -decay of  $K^{40}$ .

No attempt will be made to discuss the geological significance of the lepidolite ages here, but one of us (AMM) is utilizing them as an aid in attempting to determine the pre-Cambrian succession in Southern Rhodesia.

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# Static Electrification of Solid Particles by Spraying

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The known basic mechanisms of electrification have been classified into five or perhaps six groups (1), and it is believed that more than one of the mechanisms may operate during the process. Spray electrification of liquids has been studied by several investigators (2-7).

A commercial-type spray gun modified to produce a fine spray of variable density was used in this experiment. The spray was deposited on an insulator consisting of five sheets of polyethylene (4" x 5") bound to an aluminum backing plate (4" x 5" x 1/16"). Be-

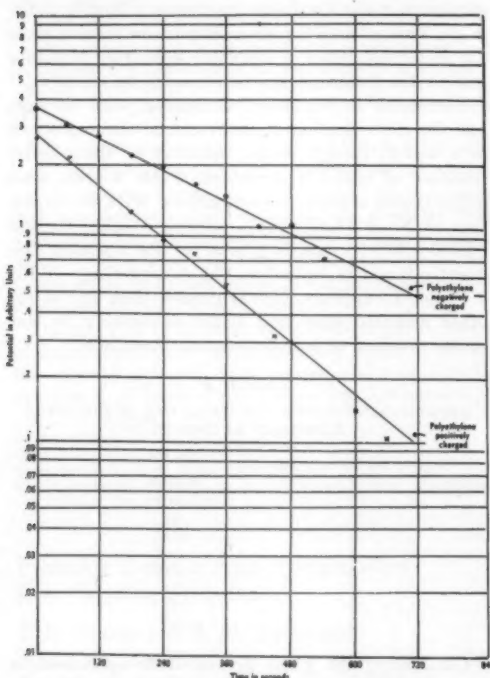


FIG. 1. Acetone spray on polyethylene.

fore the spray was deposited, the insulator was positively or negatively charged to the desired potential by means of corona wires. By running a series of preliminary tests, it was observed that for optimum condition the distance of the nozzle from the insulator and the pressure of spraying were 15 cm and 10 psi, respectively. At lower pressures reproducible data could not be obtained because a uniform spray could not be maintained. At higher pressures and at 15-cm

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TABLE 1  
HALF-TIME DECAY DATA

Cloud density	Polarity of polyethylene plate	Low (sec)	Medium (sec)	Heavy (sec)
Acetone	+	156		
	-	260		
Starch	+	Negligible		
	-	290		
Charcoal	+	464	27	13
	-	202	24	15
50/50 Charcoal starch mixture	+	110		
	-	22		

distance or more, a circular area free from particle deposit was produced, indicating that the blast effect of the spray had not been eliminated before reaching the plate; the density of spray was increased or decreased by varying the length of the needle valve stem. For these tests, three arbitrary settings on the needle valve stem were made so that a light, medium, or heavy spray density was obtained. The density was not evaluated quantitatively. After depositing the spray on the insulator for a specified length of time, the change in potential was measured by means of a sensitive electrometer. Any variation in the potential after the spray cloud was deposited on the charged plate indicated the polarity and magnitude of the

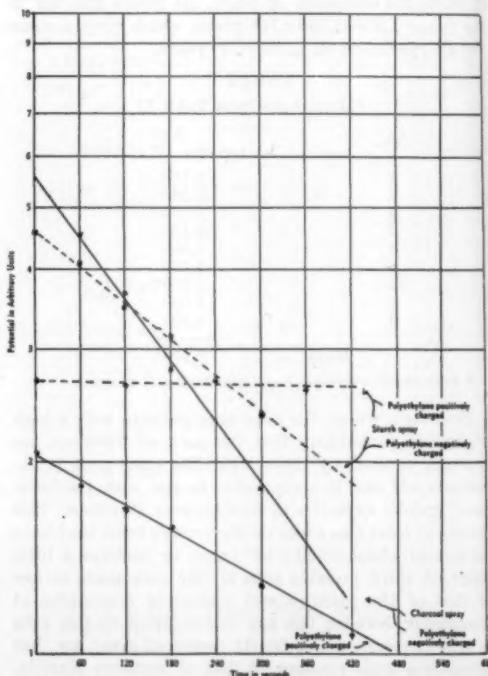


FIG. 2. Starch and charcoal spray on polyethylene.

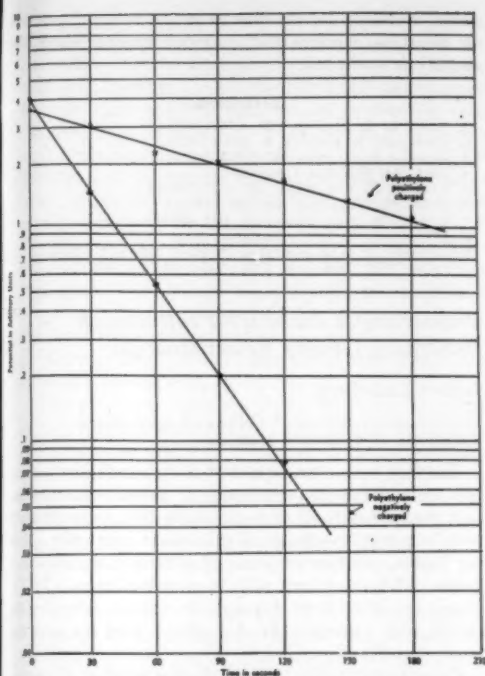


FIG. 3. 1:1 mixture of starch and charcoal spray on polyethylene.

cloud charge. By repeating the operation several times on the same plate, the rate at which the charge on the plate was "decaying" was determined.

A series of experiments was conducted on several insulators—Kodapak, mica, pliofilm, and polyethylene—to determine which would be most satisfactory. The various insulators attached to an aluminum backing plate were charged, positively and negatively, by means of corona wires. The different dielectrics behaved quite differently when charged. Polyethylene accepted a high and uniform charge repeatedly, regardless of the polarity. The other dielectrics varied considerably. For this reason polyethylene was chosen for the spray experiments (8).

Spray experiments using water, carbon tetrachloride, acetone, and glycerine were first tried to test the experimental method and sensitivity of the apparatus. Other investigators (2-5, 7, 9) have used some of these liquids to study spray electrification. In the case of dry sprays, charcoal and starch were used to study the electrification of solid particles. Powders were vacuum-dried before using.

In the case of water, carbon tetrachloride, and glycerine sprays for low-, medium-, or high-density spray clouds, no change in potential was observed on the polyethylene plate regardless of the polarity of the plate. Chapman (3, 4) observed in the case of water sprays that particles of positive and negative charges of small magnitude existed in the sprays in

approximately equal amounts, and Dodd (10) found this also existed in the case of poorly conducting liquids. This would indicate the same condition exists in the case of carbon tetrachloride and glycerine. However, for acetone spray an exponential-type decay was obtained on the polyethylene plate (Fig. 1). The half-time decay values for a low-density spray cloud were 156 sec and 260 sec for droplets deposited on a positively charged and negatively charged polyethylene plate, respectively. Thus it appears that the acetone spray contained more negative than positive carriers. Repeated tests gave results reproducible to within 10%.

For low-density spraying of powdered charcoal, starch, and a 1:1 mixture of charcoal and starch, an exponential-type decay was also obtained. The half-time decays obtained are shown in Table 1 and Figs. 2 and 3. The mixture had a considerably faster half-time decay than either of the pure powder sprays, varying anywhere from a factor of 5 to more than an order of magnitude, depending upon the material and polarity. In the case of starch the half-time decay for a spray depositing on a positively charged plate was negligible, whereas on a negatively charged plate it was 290 sec, thus indicating that the starch spray cloud had a great preponderance of positively charged particles. The charcoal spray gave half-time values of 464 sec and 202 sec for positively and negatively charged plates, respectively. Medium- and high-den-

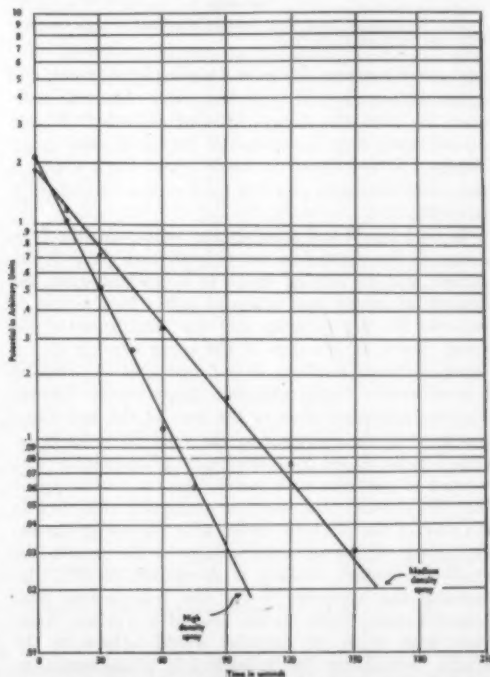


FIG. 4. Medium- and high-density charcoal sprays on polyethylene negatively charged.

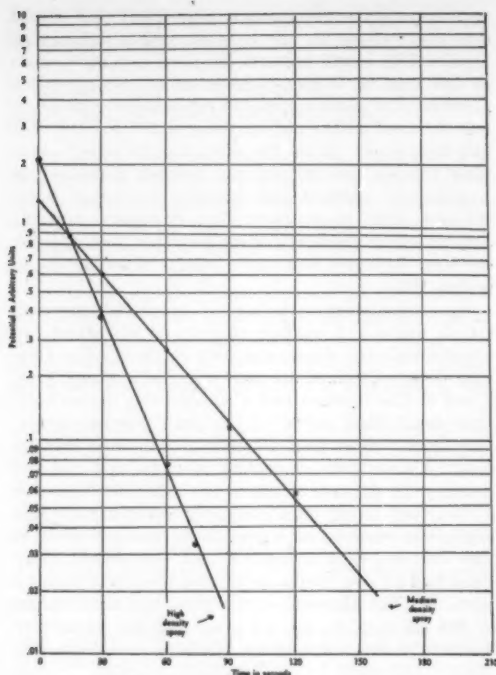


FIG. 5. Medium- and high-density charcoal sprays on polyethylene positively charged.

sity spray experiments were done using charcoal, and again the exponential type decay was obtained; however, the half-time decays were of an order of magnitude faster than in the case of the low-density spray clouds, and are shown in Table 1 and Figs. 4 and 5. Repeated tests with powders gave results reproducible to within 10%.

In both liquid and solid sprays an exponential-type decay of the charge on the polyethylene plate is obtained, and its rate of decay is dependent upon the density of spray and material used. This serves to indicate the net polarity and the magnitude of the spray cloud. In the case of the spray deposit of 1:1 charcoal-starch mixture, it is found that it produces a considerably faster half-time decay on the charged polyethylene plate than in the case of the individual powders. If the charging of the solid particles is assumed to be caused by triboelectric phenomenon—i.e., contact of particles with metal—then it would appear that the phenomenon operates at greater efficiency in the case of the mixture. Since, after spraying has begun, some of the particles adhere to the nozzle, the available contact surface is decreased, thereby decreasing the opportunity for the triboelectric phenomenon to operate. In the case of a mixture, however, both types of particles would adhere to the nozzle, permitting the triboelectric phenomenon to operate more efficiently. It would seem that the data qualitatively verify this. No satisfactory explanation

seems available for the change in the ratio of positive to negative carriers for charcoal sprays when the density is increased.

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### Prevalence of *Escherichia coli* Strains Exhibiting Genetic Recombination

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The first bacterium to be tested by an efficient selective method for the occurrence of genetic recombination was strain K-12 of *Escherichia coli*. Experiments with auxotroph mutants of this strain promptly gave conclusive, positive evidence of genetic exchanges between different mutant cells in mixed cultures (1, 2). However, subsequent attempts to obtain comparable results with a number of other strains used for genetic work were fruitless.

Cavalli and Heslot (3) examined a number of auxotroph strains from the National Type Culture Collection (England) and found one that could be crossed with K-12. Unfortunately, this isolate has a complex nutrition, so far unanalyzed, which greatly hinders further work. In other characteristics it closely resembles K-12.

It would be surprising if K-12, the first *E. coli* strain examined, should prove to be uniquely suitable for crossing experiments. Unfortunately, the method for testing fertility involved a good deal of work: it was necessary to prepare at least two nonoverlapping, double nutritional mutants from each strain. Despite improved techniques (4), such a procedure is almost prohibitive for routine survey of new strains. The following procedure was therefore put into effect for preliminary screening.

A multiple marker strain, W-1177 (= 677-sr in [5]) has been developed from K-12 by a long sequence of mutational steps. This strain differs from the wild-type strain K-12 in these markers: polyauxotrophy for threonine, leucine, thiamin; resistance to streptomycin and to bacteriophage T1; failure to ferment lactose, maltose, mannitol, xylose, galactose, or L-arabinose. These may be symbolized as:  $T-L-B_1-S^r-V_1'$  Lac-Mal- etc. Typical wild-type *E. coli* strains are  $T+L+B_1+S^r$ . These four markers are useful in detecting recombination between W-1177 and new strains to be screened. Heavy inocula of W-1177 and

<sup>1</sup> Paper No. 451. This work was supported in part by a grant from the Research Committee, Graduate School, University of Wisconsin, with funds made available by the Wisconsin Alumni Research Foundation.



of the propositus are mixed in a complete broth tube, and incubated for 6-24 hr. The mixed culture is then harvested, and the washed cells are plated on a minimal agar medium containing 100-1,000  $\mu\text{g/ml}$  streptomycin. The minimal agar selects prototroph cells; the streptomycin selects  $S^r$ . The minimal streptomycin agar thus permits the growth only of  $T+L+B_1+S^r$  colonies and suppresses the two parents. This assortment of characters can arise either by recombination, or by mutation of the propositus from  $S^r$  to  $S^+$ . Fortunately, this mutation occurs at an extremely low rate, about once per  $10^{10}$  cell divisions (6), and therefore confusion between recombinants and mutants is minimized. On the other hand, the improbable coincidence of three reverse mutations needed to produce a prototroph from W-1177 has never been observed in extensive controls (1,2).

The principal function of the screening procedure is the rational selection of cultures appropriate for more detailed analysis by the development of auxotroph mutants. Even in this preliminary test, however, recombination of unselected markers ( $V_1$ ,  $Lac$ ,  $Mal$ , etc.) among the  $S^r$  prototroph selections usually verified the occurrence of genetic interchange.

Two groups of cultures have been screened so far for cross-fertility with W-1177 (i.e., K-12). About 40 cultures from chicken cecal flora (supplied by courtesy of S. Shapiro) yielded one isolate that crosses, but very poorly. About 100 isolations from human urine cultures (secured through courtesy of the Wisconsin State Laboratory of Hygiene) have given 8 that cross with about the same facility as K-12, and an equal number that appear to be less fertile (if fertile at all), so that the evidence for recombination in the latter is still inconclusive. The possibility that some ecotypic differentiation is revealed by the breeding test deserves further study when it is recalled that K-12 is also of human origin.

Nutritional mutants are being prepared in the new isolates. The three cultures so far tested cross freely with each other, as well as with K-12 and within each strain.

The new strains differ in a number of characteristics, including fermentation patterns (3 are sucrose-positive; 6, sucrose negative; one is a lactose-negative "paracolon" type), colony morphology ( $R$ ,  $S$ , and intermediates by the acriflavine test), and patterns of resistance to and production of colicins (7) and phages. Preliminary serological studies are under way, in addition to experiments to uncover cryptic genetic differentiation. There is a strong suggestion that colicin and lysogenicity interactions may act as genetic isolation mechanisms.

Unfortunately, the survey method does not reveal other intrafertile, intersterile breeding groups, nor, owing to the dominance of  $S^r$  (8), can it reveal unreduced diploid hybrids between the different strains. Despite these shortcomings, however, the streptomycin-prototrophy selection method has succeeded in displacing strain K-12 from its position as the only "sexual" bacterium.

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## The Mode of Action of Growth Substances and Growth Inhibitors

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Previous experiments have proved (1) that alcoholic extracts of different plants show various effects in regard to elongation of cells. Interpreting these results, it is reasonable to suppose there are growth-promoting and growth-inhibiting substances in the plants. Amounts of the two types of growth regulators vary in different kinds of plants. Extracts of *Brassica* sp. show a strong growth-promoting effect, whereas extracts of *Syringa* produce a strong growth-inhibiting effect.

It was therefore of interest to study the effect of a mixture of growth substances and inhibitors by means of the *Avena* test. Larsen (2) used the Went test, taking the angle of curvature for a criterion of the effect, but his results are not very clear and are difficult to survey. Hence the question was studied again by means of Linser's (3) paste method, permitting measurement of the coleoptyl elongation ( $Z$ ) and the angle of curvature ( $\alpha^\circ$ ).

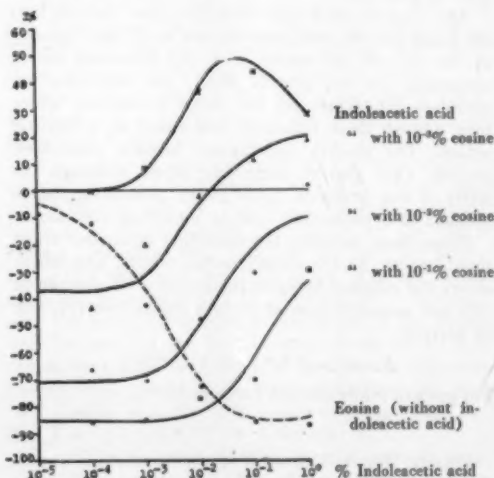


FIG. 1. Mixtures of indoleacetic acid and eosine in different concentrations. The solid lines show the curves calculated for the different mixtures of indoleacetic acid and eosine. On the left, the curve of action is calculated for eosine. The corresponding experimental values are marked as single points.

The growth substances tested in these experiments were indole-3-acetic acid (I-3-E) and an extract of Brussels sprouts; the inhibitors were eosine and a *Syringa* extract. Values for  $Z$  in the mixture I-3-E/eosine in different concentrations are shown in Fig. 1. The curves of the other possible mixtures of the above-mentioned substances were analogous but differed from those of Fig. 1 because of varying efficacy of the original substances.

The following ideas about the mode of action of the growth substances and growth inhibitors provide a possible explanation of the results.

The growth-inhibiting or growth-promoting substances must be converted into a part of the living substance, being adsorbed by molecules of "living structure." It is reasonable to postulate that in the molecular system of the living substance there are spaces that can be occupied by the molecules of the growth regulator. This means that the molecule of the growth regulator has a certain affinity for a certain "space." In this connection the ideas of R. Kuhn (4) about the mode of action of the sulfonamides may be recalled.

Our hypothesis postulates two kinds of spaces: The first filled in by growth substances effects a growth promotion; the second type also shows a certain affinity, but in this case growth inhibition results.

It is immaterial whether there is a molecular process of self-reproduction, as postulated by Dehlinger (5), Neugebauer (6), Jordan (?), or Friedrich-Freska (8), with the growth substance as a "brick" of the molecule of the living substance, or whether the active substance is effective by adsorption in a certain place with a specific metabolic function influencing the growth process.

Any organic molecules brought from outside into the plant will not ordinarily be able to fill the "spaces" of the growth substances with the necessary active compound for the growth effect. The molecules accumulate somewhere on the living structures, where they disturb their functions and exert an inhibiting action. The growth substances, besides promoting growth, have also an inhibiting effect, although the latter is less probable. Thus every growth substance consists of a promoting and an inhibiting compound.

From these theories, the following equation, which should apply to the experimental results, and which shows the relation between the increase of elongation ( $Z$ ) and concentration of growth substances ( $c$ ), can be derived:

$$Z = A(1 - e^{-k_1 c_1}) - B(1 - e^{-k_2 c_2})$$

For growth inhibitors the formula is:

$$Z = -C(1 - e^{-k_3 \sqrt{c_3}})$$

Finally, for mixtures of growth substances and growth inhibitors, the formula is:

$$Z = A(1 - e^{-k_1 c_1} - I_1 \sqrt{c_1}) - B(1 - e^{-k_2 c_2} - I_2 \sqrt{c_2}) - C(1 - e^{-k_3 \sqrt{c_3}} - I_3 c_3)$$

$A$ ,  $B$ , and  $C$  denote figures, which are proportional to the number of places of adsorption ("spaces") mentioned above;  $k$  and  $l$  denote probabilities of hits per unit of concentration. If the constants are chosen correctly, the theoretical curves can be brought into agreement with the curves established by the experiments. The curves for the mixtures I-3-eosine (Fig. 1) could be derived mathematically from the values for the different substances with good conformity.

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## Desoxyribonucleic Acid Content of Rat Liver Nuclei Influenced by Diet

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That the desoxyribonucleic acid (DNA) content of all diploid cells of an animal, and the species, is constant has been suggested by a number of investigators (1-4). This would exclude the possibility that diet influences the DNA content of nuclei. Kosterlitz *et al.* (5, 6) and Davidson (7) suggested that the DNA content of liver nuclei of rats was not influenced by fasting or by protein-free diets.

Nuclei in sections of livers of rats on a protein-free diet were observed to stain more intensely by the Feulgen nuclear reaction than those of rats on the laboratory stock diet, and the results of the present investigation obtained by both chemical and cytochemical methods indicate that the diet does influence DNA content of nuclei of rat livers.

Male rats from the Albino Farms, Red Bank, N. J., 130-160 g, were maintained on one of three diets: Fox Food Blox (Allied Mills), which contained a minimum of 26% protein; a semisynthetic diet containing 12% washed casein (Eimer and Amend); and a protein-free diet (Table 1).

Nuclei were prepared from the livers with 5% cold

TABLE 1  
COMPOSITION OF DIETS

	12% casein diet (%)	Protein- free diet (%)
Casein	12.0	0.0
Corn oil	5.0	5.0
Dextrose	77.0	89.0
Salt mixture	4.0	4.0
Rice bran extract (Vitab)	2.0	2.0
Riboflavin	0.002	0.002

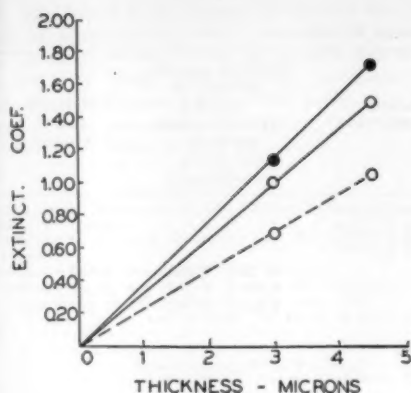


Fig. 1. Relation of density of Feulgen color in nuclei to thickness of sections. ●—●, Protein-free diet; ○—○, 12% casein diet; ○---○, Fox Food Blox diet.

citric acid by the method described by Marshak slightly modified (8) after the livers had been perfused *in situ* with cold 0.85% sodium chloride solution.

The number of nuclei per ml of the nuclear suspensions was determined by means of a blood cell counting chamber. The amount of DNA in known numbers of nuclei was determined by a slight modification of the method described by Kosterlitz (5). The suspensions contained all types of liver nuclei. A comparison of the relative amount of DNA in the hepatic nuclei was made by a photometric comparison of the Feulgen color in the nuclei of sections. Tissue specimens from each group were mounted together and cut with the same stroke of the microtome knife; this assured equal thickness of sections. Ten oil immersion fields per section were photographed with green light (Wratten B Filter, 4-mm obj., 10× ocular) and constant exposure times.

Densitometric measurements were made as described elsewhere (9). The circular, or slightly elliptical, film images of hepatic nuclei were projected through a circular opening onto the photoelectric element of the densitometer. The opening in the densitometer was great enough to admit the whole projected nuclear image. The fit of image into the opening was not always exact, and with slightly oval images some of the background field was admitted. This introduced a slight error common to all sections. Approximately 100 nuclei were measured from each liver. The accuracy of the method was tested by measurements of sections cut at 2 different thicknesses. Fig. 1 shows that as thickness of section was increased there was a corresponding increase in Feulgen color.

In order to determine if any differences found in the DNA content of the nuclei from the three dietary groups were due to changes in ploidy, the diameters of a minimum of 10,000 nuclei (from the nuclear suspension from 10 rats) of each group were meas-

ured with a filar micrometer. All spherical nuclei, regardless of size, were measured. The results of the measurements of nuclei of each group were condensed so that the intervals are 1  $\mu$  and extend from 4.5 to 18  $\mu$ . The volume of the average nucleus at each interval was calculated on the assumption that the nuclei were spherical.

It may be seen in Fig. 2 that the nuclei of the livers of the rats fed the protein-free diet were the smallest of the three groups, those of the 12% casein diet intermediate, and those of the Fox Food Blox the largest. The graph does not include a small number of the largest nuclei of the groups; there was no appreciable difference between the groups among these nuclei.

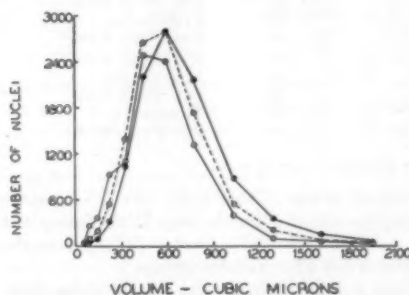


Fig. 2. Comparison of volumes of nuclei of livers from rats fed different diets. ○—○, Protein-free diet; ○---○, 12% casein diet; ●—●, Fox Food Blox diet.

The mean volumes of the nuclei from the three dietary groups were as follows: Fox Food Blox diet, 572  $\text{cu } \mu$  (10,196 nuclei); 12% casein diet, 494  $\text{cu } \mu$  (10,126 nuclei), or 13.6% smaller than those from the Fox Food Blox diet group; protein-free diet group, 372  $\text{cu } \mu$  (10,280 nuclei), or 35% smaller than those from the animals fed the Fox Food Blox diet.

The results of the chemical determinations of DNA in isolated liver nuclei and of the photometric comparison in histological sections of the amount in the hepatic nuclei of livers of rats of the three dietary groups are shown in Table 2, a and b. It may be seen that with the diet of Fox Food Blox the average nucleus, although largest in volume of the three groups, contained the smallest amount of DNA,  $1.02 \times 10^{-8}$  mg; with the 12% casein diet the nuclei contained an average of  $1.17 \times 10^{-8}$  mg DNA/nucleus; with the protein-free diet, in which group the nuclei were the smallest, the nuclei contained the most DNA per nucleus,  $1.20 \times 10^{-8}$  mg. The values were approximately 18% greater with the protein-free diet and 15% greater with the 12% casein diet than with the Fox Food Blox diet.

The DNA content of the hepatic nuclei, compared photometrically (Fig. 3), was 50% greater ( $P < 0.01$ ) in the rats fed the protein-free diet than in those from the rats fed the Fox Food Blox diet, although the nuclei in the latter were approximately 14% larger than those of the other two groups, which

TABLE 2  
DNA CONTENT OF RAT LIVER NUCLEI

No. rats	Days on diet	Diet	DNA/nucleus (chemical method) mg	Relative amount of DNA in nuclei (cytochemical method) extinction coefficient	Relative size of nuclei†	
a	27	8-49	Fox Food Blox	$1.02 (\pm 0.009^*) \times 10^{-8}$		
	26	"	12% Casein	$1.17 (\pm 0.010) \times 10^{-8}$		
	27	"	Protein-free	$1.20 (\pm 0.008) \times 10^{-8}$		
b	9	15-40	Fox Food Blox		$0.723 \pm 0.084$	$2.563 \pm 0.486$
	9	"	12% Casein		$0.961 \pm 0.092$	$2.240 \pm 0.094$
	9	"	Protein-free		$1.090 \pm 0.063$	$2.241 \pm 0.136$
c	5	60	Fox Food Blox	$0.98 \times 10^{-8}$		
	5	30	12% Casein +	$1.00 \times 10^{-8}$		
		30	Fox Food Blox			
	5	30	Protein-free +	$1.00 \times 10^{-8}$		
		30	Fox Food Blox			
d	5	60	Fox Food Blox		$0.808 \pm 26.5$	
	5	30	12% Casein +		$0.808 \pm 11.7$	
		30	Fox Food Blox			
	5	30	Protein-free +		$0.844 \pm 14.4$	
		30	Fox Food Blox			

\* Standard error of mean.

† Weights of 100 cutouts of projected nuclear images.

were equal in size (Table 2, b). The DNA content of the hepatic nuclei from the rats of the group fed the 12% casein diet was also greater (33%) than that of the Fox Food Blox diet fed group.

When groups of rats were fed the three diets for 30 days, and then fed Fox Food Blox diet for an additional 30 days, no significant difference ( $P > 0.05$ ) was found in the DNA content of the nuclei of the livers from the three groups (Table 2, c and d).

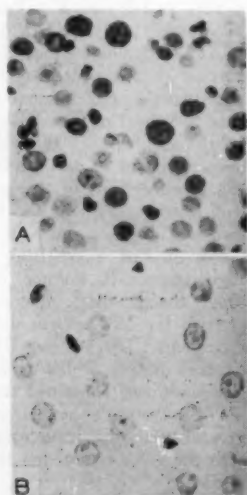


FIG. 2. Feulgen-stained sections of rat liver. ( $\times 450$ .) A, Protein-free diet; B, Fox Food Blox diet. The sections were mounted and stained on the same microscopic slide, photographed on the same strip of film with equal exposures; the prints were made under identical conditions of exposure and development. The intensity of Feulgen color varies considerably among the nuclei.

The average DNA content of  $1.02 \times 10^{-8}$  mg/nucleus for rat liver is in agreement with that found by Dounce and co-workers (10) and with that of Day (11), who reported an average of  $1.02 \times 10^{-8}$  mg/nucleus based on the thymine content.

The increase in nuclear DNA content caused by the diets apparently cannot be accounted for on the basis of increase in polyploidy if size of nuclei is used as the criterion of polyploidy, since the values for DNA were in the reverse order of nuclear size.

There appears to be a definite relationship between nuclear DNA content in the rat liver and the nutritional state of the animal. For example, three groups of 10 rats each, initially equal in weight, fed the three diets for 8-37 days, had average final weights of: Fox Food Blox diet, 278 g; 12% casein diet, 177 g; protein-free diet, 117 g. The DNA contents of the nuclei of the three groups were in the reverse order of magnitude. In the experiments the nuclear DNA content was increased when the protein content of the diet was decreased.

These results do not support the suggestions made by Kosterlitz (5), Campbell and Kosterlitz (6), and Davidson (7) that fasting and protein-free diets do not influence the DNA content of nuclei. A probable explanation for the difference between these results and those of Davidson is that in Davidson's experiments rats were fasted for 24 hr, whereas the experimental period in our experiments varied from 8 to 49 days. The evidence presented by the other investigators appears to be indirect; the nuclei were not isolated, not counted, and the DNA was not estimated per nucleus.

An explanation for increased DNA in the nuclei of the livers of rats fed nutritionally poor diets, as found in these experiments, is not clear. A suggestion is found, however, in the work of Leuchtenberger

(12), who found with Sarcoma 180 that in the early stages of pycnosis there was a considerable increase of DNA in the nuclei. It may be possible that under inanition liver nuclei enter a similar condition, and under continued stress many of the nuclei may pass through severe pycnosis and disappear, thus reducing the number of nuclei in the liver.

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### A Suggested Simplification of Blood Volume Analysis Using the Dye T1824

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The analysis for blood volume as initially practiced (1) involved drawing a "blank" blood specimen, injection of the dye, and the withdrawal of four additional dyed blood specimens at noted time intervals. Subsequent workers (2, 3) established that satisfactory results were obtainable through the use of a "blank" blood, injection of the dye, and blood withdrawal to obtain a "dyed" specimen 10 min after injection of the dye.

The use of the plasma blank, although theoretically correct, is of questionable value in view of problems arising from differences in turbidity and/or degree of hemolysis (1, 3-5) between the blank and dyed specimen.

The observation (3) that the absorbency of the dye T1824 in plasma at 680 mμ is one fourth the absorbency at 620 mμ has suggested the following experiment designed to demonstrate that the blank specimen is not required.

Pooled plasma specimens were prepared to contain known amounts of the dye T1824, and the samples were blanked out against the same undyed plasma specimen, other undyed plasma specimens, and 0.9% saline containing 2 ml plasma/100 ml (Table 1). The optical density at 680 was subtracted from the optical density at 620, and the result multiplied by 4/3, yielding the corrected optical density that could be equated to μg dye/10 ml plasma:

$$OD = 4/3(OD_{620} - OD_{680}),$$

where OD is corrected optical density, and  $OD_{620}$  and  $OD_{680}$  refer to readings made at these respective wavelengths in mμ.

TABLE 1  
RECOVERY OF THE DYE T1824 USING DIFFERENT  
BLANK PLASMAS OR SOLUTIONS

Sample No.	μg T1824 added to prepared sample	μg T1824 found			
		Undyed plasma blank	Plasma A blank	Plasma B blank	0.9% saline containing 2% plasma
1	18.8	18.9	18.9	21.3	20.6
2	31.3	32.4	31.5	31.8	31.2
3	37.5	38.7	38.2	38.2	37.0
4	50.0	50.5	51.8	50.5	49.8

It is advantageous to use a plasma blank, rather than a "water" blank, since readings can be made in the most accurate range of the spectrophotometer scale.

Using this technique, the procedure for determining blood volume is thus simplified to injecting the dye and obtaining a single blood specimen at a noted time interval.

Since in time of an emergency particularly, many of the patients whose blood volumes are required are receiving blood, plasma, or other fluids parenterally, the injection of the dye could be made through the tubing connecting the fluid reservoir with the vein. In this form the blood volume analysis is simplified to the point where the patient need be approached but one time to obtain a single "dyed" blood specimen, which can be used to establish the required hematocrit reading as well.

Interesting details concerning the variations in blood volume during parenteral therapy could be established by taking blood samples subsequent to the administration of the dye, using the correction factor established for excretion of dye (3).

$$OD(\text{zero time}) = OD_t(1 + .00187t),$$

where  $OD_t$  is optical density of the specimen, obtained as above, and  $t$  = time in minutes after the injection of the dye.

The blood volume is readily calculated from the optical density at zero time by familiar procedures.

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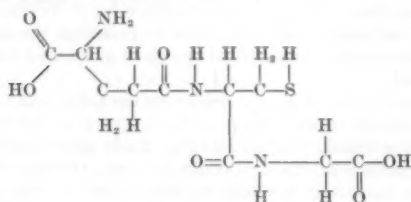


# Comments and Communications

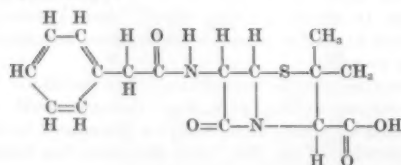
## In Vitro Production of Cortisone

IN YOUR issue of November 3, 1950 (*Science*, 112, 524), there is a most interesting account by Dr. Seneca *et al.* of the production *in vitro* of cortisone from desoxycorticosterone by various mammalian tissues, and especially by the adrenal gland. I believe, however, that in explaining the observed facts the authors have overlooked one most important thing, namely, that to every flask they had added 10,000 or 50,000 units penicillin G and 3.34 ml propylene glycol. In all instances where, moreover, glutathione had been added, the results were consistently negative.

The fact that in the flasks with penicillin but without glutathione nearly always the formation of cortisone by adrenal tissue was demonstrable, whereas this was consistently lacking in the flasks containing the same ingredients plus glutathione, seems to indicate that in the latter case glutathione inhibited cortisone formation. Now glutathione



and penicillin G



have so large a part of their structures in common (*cf.* E. Fischer, *Science*, 105, 146 [1947]) that competitive inhibition becomes a possibility. And, if so, the preliminary conclusion should be that it is penicillin G that is the active catalyzer of the formation of cortisone in these experiments—a point well worth further experimental confirmation in order to promote both a deeper insight into the mode of action and the chemical potentialities of penicillin, on one hand, and perhaps the artificial preparation of glucocorticoids from readily available desoxycorticosterone, on the other.<sup>1</sup> But at the same time we must realize that these experimental results are not to be considered as experimental evidence in support of Lewin and Was-

<sup>1</sup> A further implication may be that the rapid clinical recovery from infections by penicillin may be in part due to the bacteriostatic action of the antibiotic, but in part also to a rapid readaptation in the sense of H. Selye, by the increased production of glucocorticoids. This "aspecific" effect of penicillin also merits further investigation.

sen's views, for in the living body no penicillin is present unless expressly administered. On the other hand, penicillin may then be a powerful adjuvant to their method of treatment of rheumatoid arthritis with desoxycorticosterone acetate plus ascorbic acid, as well as of the same mode of treatment in psychiatry proposed by M. Möller (*Svenska Läkartidn.*, 43, 475 [1946]); R. Jens (*Northwest Med.*, 48, 609 [1949]); E. H. Cranswick and T. C. Hall (*Lancet*, I, 540 [1950]); G. Fachini, F. Ceresa, E. Morpurgo, and Z. Korenyi (*ibid.*, 734); and H. Bourne (*ibid.*, 925). Perhaps the therapeutic success of these methods may thus be made more convincing.

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WE HAVE read with interest Dr. Grevenstuk's comments on our paper dealing with the *in vitro* production of cortisone by mammalian cells (1). It is our opinion, however, that lack of experimental evidence does not warrant Dr. Grevenstuk's conclusions concerning the role played by penicillin.

Penicillin was apparently not included in the systems employed by McGinty *et al.* (2), when they incubated Compound S with adrenal homogenates, and isolated Compound F, a substance very closely related to cortisone. Neither did the workers at the Worcester Foundation, apparently, employ penicillin when they produced corticosterone by the method of adrenal perfusion (3).

Dr. Grevenstuk's suggestion that penicillin therapy in infectious diseases involves a readaptation in the sense of H. Selye might be valid. It may readily explain the favorable results obtained in some cases of rheumatoid arthritis when treated with gold salts; this might be thought of as an activation of the adrenal cortex to produce glucocorticoids. No evidence, however, exists as yet showing that penicillin has any stimulating effect on the adrenal cortex in normal animals.

Although the formulas of penicillin and glutathione (GSH) may be written to resemble each other, there appears little evidence that any definite biological relation exists between these two compounds. The reference cited by Dr. Grevenstuk (Fischer) states: "... It would be too far-reaching to draw, without experimental basis, any conclusion from this circumstance [resemblance of the formulas of penicillin and GSH], but one may think of the possibility of penicillin competing with glutathione for enzymatic or other mechanisms important for microbial [italics ours] reproduction." There are some clinical observations on a few cases in which penicillin injections appeared to have caused a transient rise in the blood level of GSH but did not change the blood level of oxidized glutathione (GSSG) (4, 5). This fact in

itself might arouse suspicion, especially when another investigator claims that GSSG acts as an "H-acceptor" after penicillin injections (6). In a study carried out with microorganisms, it was concluded that "such simple experiments do not themselves afford unequivocal proof of the participation of glutathione in the mechanism of penicillin action. However, it is generally assumed [italics ours] that -SH groups are involved" (7). Penicillin was found to inhibit the enzymic hydrolysis of GSH, but this inhibition could be overcome by the addition to the medium of more GSH and glutamine (8). If the -SH groups of GSH would be blocked, then the addition of GSH to our medium could not be expected to inhibit the oxidation-reduction system postulated by us. It certainly could not inhibit the synergism caused by insulin. The complete inhibition whenever an excess of GSH was added may be better explained by the well-known inactivation of insulin in the presence of GSH, or by its ability to keep the added vitamin C or other still unidentified factors in their reduced states.

Penicillin is known to be inactivated rapidly at 37°C, the temperature at which all our experiments were carried out, but the nature of the inactive end product is not known, nor is it definitely established by what mechanism the bactericidal action of penicillin proceeds. The hypothesis is advanced that some assimilatory processes are blocked at the cell walls, such as the assimilation of glutamic acid (9). One might speculate that some of the biological activity of penicillin is related to its optical configuration, which happens to be the "unnatural" one, and that penicillin may be able to enter metabolic process in microorganisms capable of metabolizing compounds having the D-configuration. Whether such reasoning still holds for mammalian cells is debatable. Many enzyme preparations from mammalian cells, for instance, serve usefully in the enzymic resolution of amino acid racemates.

It is very dangerous to compare *in vitro* experiments with clinical cases, because of the extreme differences in conditions. Clinically, the favorable results obtained in cases of rheumatoid arthritis with DOC plus vitamin C are open to question, and, according to the most recent clinical findings, previous favorable results have not been confirmed. It is therefore fallacious to advocate clinical trials involving penicillin as an adjuvant to DOC plus vitamin C on the basis of speculative inferences drawn from *in vitro* experiments. The favorable results obtained by the combined use of DOC plus vitamin C in psychiatric cases are also being questioned. Clinically, the combined cortisone and insulin shock therapy in psychiatric treatment gave immediate favorable results in about 50% of the cases (10), but the final result was not different from insulin shock therapy alone after discontinuance of cortisone.

In a preliminary report on clinical trials (11) it was shown that the administration of insulin reduced the cortisone requirement in the treatment of rheumatoid arthritis in all stages by as much as 75% of

the dosages usually given, and that this type of therapy apparently eliminated all the usual objectionable side effects of cortisone. None of these patients had received penicillin at any time immediately preceding this type of therapy.

These are but a few of the reasons why we have not taken penicillin into consideration as an active participant in our system. We believe that penicillin serves no other purpose than to keep our system free of bacterial contaminants, and that any other conclusions drawn from our experiments with respect to the action of penicillin cannot be supported on the basis of experimental facts available up to date.

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11. HENDERSON *et al.* *J. Clin. Endocrinol.*, **10**, 800 (1950).

#### The Monarch Butterfly

IN YOUR pages (*Science*, 113, 68 [1951]; see also p. 729) there was published an article by W. D. Field, J. F. Gates Clarke, and J. G. Franclemont on the Commission's decision that in future the name *Papilio plexippus* Linnaeus (1758) shall apply to the butterfly known in America as the Monarch, thus putting an end to a controversy that has troubled lepidopterists for at least a generation.

In the Minutes of the Paris Meeting of the Commission, this decision is recorded in the following words:

- (1) to use their plenary powers to direct that the trivial name *plexippus* Linnaeus, 1758 (as published in the binomial combination *Papilio plexippus*) should be applied to the American species figured as *Danaus plexippus* by Holland (W. J.), 1931, *Butterfly Book* as figure 1 on plate 7;
- (2) to place the name . . . as determined in (1) above on the *Official List*. . .
- (3) to render an Opinion setting out the decisions recorded in (1) and (2) above.

This statement, for which I take my full share of responsibility, means no more, and no less, than it says. It does not fix any "type" specimen or "type" figure of *plexippus* and it does not imply that the figure to which reference is made belongs to any particular subspecies of *plexippus* from any particular "type" or other locality. It says, in effect, only that

this is a figure of the species with which we are dealing. Nobody can deny that Holland's figure represents a specimen of *Danaus plexippus*. That issue, therefore, is settled.

However, it was very soon pointed out quite conclusively by Field (*Proc. Entomol. Soc. Wash.*, 52, 234 [1950]), that Holland's figure was not of *Danaus plexippus plexippus*, but of *Danaus plexippus megallippe* Hübner (or *nigrippus* Haensch), the Central and South American subspecies. Though I cannot see that this fact is really of the slightest importance, I admit it would have been better had a figure of *D. plexippus plexippus* been quoted. For this "error" I am to blame, not Hemming, though in fairness to myself I must reaffirm that I considered, and still consider, that any good, easily accessible figure of *D. plexippus*, of any race or subspecies, would serve the Commission's purpose. Nevertheless, Field argued on the basis of his findings that "the Commission did not fix the name *plexippus* to the North American Monarch . . . but to a distinct subspecies," a statement for which I cannot find the slightest support in fact or in logic.

In order that the Commission might consider how best to remove from the minds of lepidopterists the doubts (however unjustifiable) that had arisen through the reference to Holland's figure, it was decided to consult a sample of well-known lepidopterists on this specific point, prior to rendering the necessary Opinion. The letter and draft application to the Commission subsequently sent out did unfortunately contain errors of fact, to which your correspondents properly call attention. It would have been but common courtesy to have called the Secretary's attention to these, especially as the circular was a personal inquiry from the Secretary upon which the personal views of the recipients were sought.

However, as your correspondents preferred to comment publicly and in the severest terms on these private communications, and on the prior action of the Commission, it may be well to point out some of their own errors.

i) It is false to charge the Commission with having committed in Paris "a serious error" "in haste": your correspondents are in error in reading more into this decision than is there; and to reach a decision quickly on a matter that had been before the Commission a year or more, and before the lepidopterological public some 25 years at least, cannot justifiably be called "hasty."

ii) "Hemming's campaign to replace the Law of Priority by *Nomina Conservanda*." There is no such campaign; on the other hand, there is very strong pressure upon the Commission from all parts of the world to put an end to uncertainties and unnecessary changes in generic and specific names, and I am convinced the methods now being adopted, including in particular the expansion of the *Official List*, are the best for the purpose.

iii) The "careful lectotype designation already published" does not exist. The reference is no doubt to

Corbet's paper (*Proc. Roy. Entomol. Soc. London*, B, 18, 184 [1949]). Corbet's words are, "I have no hesitation in taking the male specimen bearing the Linnean name label as the name-type of *P. plexippus* Linnaeus, 1758." This is not a lectotype designation; it is a claim to have recognized the holotype. [The authors of the article make no reference to the fact that, in spite of this, Corbet's article ends with the statement that in submitting his application to the Commission he recommends the retention of the name *plexippus* for the American Monarch butterfly.]

iv) "Hemming neglected . . . several prominent interested lepidopterists." This statement is unworthy of your correspondents. No attempt was made to send the circular to all interested lepidopterists. A random sample, whose names were supplied mainly by me, was taken. Would I have selected the authors of this article had my choice been biased? Nevertheless, I regret that other names did not occur to me at the time.

v) The Commission having reached its decision on the application of the name *plexippus*, a decision endorsed by Congress, it is not open to the Commission to "reconsider" the matter, as requested by your correspondents.

Much more could be written in criticism of your correspondents' article. But there is much wisdom in the old saying "least said soonest mended." I have no wish to add bitterness to this controversy. It requires objective cooperation, not polemics.

N. D. RILEY

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## Up or Down?

E. C. ZIMMERMAN's note (*Science*, 113, 391 [1951]) on volcanism as a contributing factor in change of sea level states that the outpouring of lava on the sea bottom has been sufficient to raise sea level as much as 500 meters, "even if generous allowance is made for compensating subsidence."

It would appear to me that the "accompanying subsidence" would have been 100% *plus* the volume of new land raised *above* sea level. Thus the net result would be a slight *lowering* of sea level. If subsidence did not equal the displacement of outpouring there would have had to remain gas-filled cavities and this seems untenable.

CHAPMAN GRANT

San Diego, California

## Erratum

In Table 1, on page 675 of our article entitled "An *In Vitro* Method of Screening Amoebicidal Agents Using the Phillips Culture" (*Science*, 112, 674 [1951]), the formula 7-iodo-5-sulphonic acid-8-hydroxyquinoline should read 7-5, diiodo-8-hydroxyquinoline.

G. W. RAWSON

Microbiological Laboratories  
Ciba Pharmaceutical Products, Inc.  
Summit, New Jersey

## Book Reviews

**Remington's Practice of Pharmacy.** 10th ed. E. Furlerton Cook and Eric W. Martin, Eds. Easton, Pa.: Mack Pub., 1951. 1,616 pp. \$16.00.

This new edition of *Remington's Practice of Pharmacy* is a most comprehensive treatise of the numerous aspects comprising the information so essential to a thorough understanding of the pharmaceutical profession. The edition has been prepared by the editors in collaboration with 49 associates, many of whom have long-established records of authority in their particular field.

Following the pattern set in the 9th edition, the latest Remington is made up of 15 parts under the following headings:

"Pharmaceutical Background," "Technical Operations in Pharmacy," "Galenicals and Other Pharmaceutical Preparations," "Inorganic Chemicals," "Organic Chemicals," "Testing and Analysis," "Laws Governing Pharmacy," "Professional Pharmacy," "The Pharmacist in Public Health," "Business Methods in Pharmacy," "Hospital Pharmacy," "Biological Products," "Perfumery and Cosmetics," and the appendix. The latter contains chapters on "Useful Formulas," "Antidotes," a glossary of medical terms, and a list of pharmaceutical manufacturers.

There are 121 chapters covering academic and practical information in the customary well-organized, logical, and efficiently presented fashion. It is noteworthy that the many illustrations are of modern equipment and procedures that enhance the educational features of the book. Every chapter has been sufficiently revised to include the latest developments, and obsolete material has been deleted. Unfortunately, some preparations which are no longer official have been allowed to retain the U.S.P. and N.F. designation, such as Kataplast of Kaolin. References used in some parts appeared in the literature as late as 1951. Many of the most recent compounds and pharmaceutical preparations are included, as well as the latest advances in physical and chemical concepts, which are clearly and concisely presented.

Part I is of particular interest to the beginner. It contains chapters on scope, history and ethics, literature, and research, which offer an adequate orientation to the profession. The chapter on incompatibilities presents a different approach to the problems encountered in compounding prescriptions with ingredients that may be antagonistic. The subject matter is adequate and adaptable to the modern type of prescription ingredients. Up-to-date material is presented concerning solubility and isotonic and buffered solutions.

The chapter on "Dental Preparations" could well be expanded to be of still greater service to the practicing pharmacist. The chapter dealing with statistical analysis is particularly significant in view of the importance of this information in analysis and research.

No other pharmaceutical text contains such material. "The Pharmacist and Venereal Disease Control" is a valuable and interesting chapter.

The 10th edition of *Remington's Practice of Pharmacy* continues the precedent of the previous edition by providing excellent, encyclopedic information, prepared in a readily available form, for all those engaged in any phase of the pharmaceutical profession. Some sections of the book, particularly the one dealing with galenical preparations, might well serve as texts. For the most part, however, the material on specific subjects does not replace textbooks devoted solely to a given subject.

M. L. NEUBOTH

*School of Pharmacy  
Medical College of Virginia*

**Yellow Fever.** George K. Strode, Ed. New York-London: McGraw-Hill, 1951. 710 pp. \$9.50.

The activities of the International Health Division of the Rockefeller Foundation in the world-wide campaign against yellow fever over a period of more than 30 years, resulting in the publication of 422 scientific articles, the expenditure of nearly \$14,000,000, and the distribution of more than 28 million doses of vaccine, are summarized in a most interesting manner.

The 9 contributors are staff members of the Rockefeller Foundation now in New York. Their respective sections of the volume are entitled: "Landmark in the Conquest of Yellow Fever," Andrew J. Warren; "The Virus," Max Theiler; "The Pathology of Yellow Fever and the Mammalian Host in Yellow Fever," John C. Bugher; "Immunology," Kenneth C. Smithburn; "The Arthropod Vectors of Yellow Fever," Loring Whitman; "The Clinical Aspects and Diagnosis of Yellow Fever," J. Austin Kerr; "Epidemiology," Richard M. Taylor; "Controlling Yellow Fever," Hugh H. Smith; "Cost and Man Power," George K. Strode.

In summarizing the investigations and control program against yellow fever undertaken by the Foundation, there is contained within this volume the latest and most complete account of the disease. Although the Reed Commission elucidated the basic epidemiological facts that permitted control of urban yellow fever in this hemisphere and raised hopes for its eradication, subsequent experience proved this impossible through *Aedes aegypti* control. The piecemeal addition to our knowledge by the isolation of the etiological agent, the finding of suitable experimental animals, development of vaccines and the mouse protection test, the occurrence of yellow fever in the absence of *aegypti* mosquitoes, discovery of primate and other mammalian reservoirs, the various culicine vectors, identity of the disease in Africa and South America but with epidemiological differences on the two continents, application of modern insecticides in



control programs, and the development of species eradication are recorded with a fascination expected only in a novel.

The complicated epidemiology of this disease brought into the research team scientists skilled in the nonrelated fields of mammalogy, entomology, ecology, and even ornithology. The new approaches and the techniques developed during the campaign against yellow fever are of the greatest importance in attacks upon other arthropod-borne diseases. Every public health worker, epidemiologist, virologist, medical entomologist, and medical historian should read this authoritative and absorbing contribution. The Rockefeller Foundation is to be congratulated for its sustained effort to solve this puzzle and for the devotion and brilliance of its scientists.

E. HAROLD HINMAN

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University of Oklahoma*

**Sourcebook on Atomic Energy.** Samuel Glasstone.  
New York: Van Nostrand, 1950. 546 pp. \$2.90.

This book was prepared as a result of the American Textbook Publishers Institute asking the Atomic Energy Commission for a comprehensive source book on atomic energy for the use of textbook authors and editors. As the chairman of the commission states:

In his search for material, Dr. Glasstone studied the work in the Commission's various laboratories and the files of reports on scientific work. The manuscript was reviewed by a number of scientists associated with the Atomic Energy program for technical accuracy, and has benefited also by the suggestions offered. It was reviewed by the Atomic Energy Commission office of classification to make certain that the publication in no way jeopardizes national security.

The book presents a large amount of information in a manner that teachers of elementary science in colleges, and even in the upper grades of high schools, will find usable. Starting with the foundations of atomic theory, constituents of the atoms, energy and radiation, and structure of the atom are discussed. The classical phenomena of natural radioactivity, and the measurements of radioactivity are then treated. This is followed by a chapter on nuclear radiation and isotopes. The accelerators of charged particles are treated in some detail. The modern development of artificial radioactivity, nuclear transmutation, the discovery of the neutron, and the problems of nuclear structure and nuclear forces form an introduction to the discussion of nuclear fission and the utilization of nuclear energy, as well as the discovery of new elements and the uses of isotopes.

A chapter on cosmic rays and mesons and a discussion of radiation protection and health physics close the book.

This outline shows that the book is really much more than a source book on atomic energy; it is really one of the most readable texts in modern physics and as

such will be a welcome addition to the libraries of physicists, chemists, biologists, and practicing engineers. Every chapter is well illustrated by diagrams and photographs. The book is up to date, and one might only wish that it had been written after November 1950, when the Atomic Energy Commission declassified much additional material. We hope that new editions will soon be necessary. In this case it would be desirable to bring the chapter on nuclear reactors up to date, to give a more detailed outline of the problems in reactor design and reactor technology which are now accessible to a larger audience than before.

In its aim to help teachers and research men the book undoubtedly will be extremely useful. However, for textbook authors, editors, and particularly students, it would be desirable if the large amount of understandable and readable material could be supplemented with a bibliography enabling interested readers to refer to original papers and study details which obviously could not be discussed in a volume this size.

The book can be highly recommended because of its scope and the accuracy with which material has been interpreted.

KARL LARK-HOROVITZ

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**Biometric Analysis: An Introduction.** Alan E. Trelor. Minneapolis: Burgess Pub., 1951. 251 pp. \$4.50.

This is an offset-printed book with letter-size pages, paper covers, and spiral wire binding, presenting a neat if collegiate appearance. The text is easily read and the format attractive. The book follows lines of elementary teaching, with emphasis on logic rather than on mathematics, and on large-sample theory. Practical problems are regarded as better adapted to specific fields of application than to general presentation.

Chapters on numerical description and objectivity, and on variation and probability, set up some of the logic and definitions. A chapter on frequency distribution, with diagrams and tables, begins the more exact treatment. It is followed by chapters on measures of central tendency, of variation, form of variation, and on the normal curve. In these, diagrams, arithmetical and algebraic developments occur, methods of calculation are described, and moments, kurtosis, and skewness are introduced. Discussions of cumulative curves, sampling error, and tests of significance of differences follow. Next, proportions and ratios are studied, introducing binomial and Poisson distributions, and rates in vital statistics are discussed. Use of chi square is then developed; later, tests of independence are described. Correlation and regression are developed, with emphasis on bivariate distribution. The book concludes with several of the common reference tables, as well as one on functions of  $N$  ( $1/\sqrt{N}$ ,  $N/(N-1)$ , etc.), which should prove convenient.



There is little in the nature of derivation or proof; much logic, many diagrams, much rather simple algebra, and less arithmetic than in most such treatments are found. A few exercises are presented. References are few and are treated as incidental.

Small-sample procedure is kept in the background. The author draws some inspiration from J. Arthur Harris, but fails to present his greatest contribution, intraclass correlation, which was a steppingstone to progress. Analysis of variance rates only a few lines. This will seem to many a glaring omission, since this

process is an outstanding development of the last quarter century, which has opened many experimental doors. Many recent advances in mathematical statistics are not treated at all.

The book will be of limited interest and help to elementary students. It orients the reader toward the classic work of Karl Pearson. It will not satisfy either the student of mathematical statistics or the applied statistician with deep experimental interest.

F. M. WADLEY

Department of the Navy

## Scientific Book Register

*Proceedings of the Second Clinical ACTH Conference*; Vol. 1: *Research*; Vol. 2: *Therapeutics*. John R. Mote, Ed. Philadelphia: Blakiston, 1951. Vol. 1: 531 pp.; Vol. 2: 716 pp. \$8.50 a volume.

*Crep of Metals*. L. A. Rotherham. London: Institute of Physics, 1951. 80 pp. 15 s.

*Genetics in Ophthalmology*. Arnold Sorsby. London: Butterworth; St. Louis: Mosby, 1951. 265 pp. \$9.50.

*The Infectious Diseases of Domestic Animals: With Special Reference to Etiology, Diagnosis, and Biologic Therapy*. 2nd ed. William Arthur Hagan and Dorsey William Bruner. Ithaca, N. Y.: Comstock, 1951. 920 pp. \$8.00.

*Handbook of Experimental Psychology*. S. S. Stevens, Ed. New York: Wiley; London: Chapman & Hall, 1951. 1,436 pp. \$15.00.

*Comparative Anatomy of the Vertebrates*. Theodore H. Eaton, Jr. New York: Harper, 1951. 340 pp. \$4.00.

*Problems of Consciousness*. Transactions of the First Conference, March 20-21, 1950, New York. Harold A. Abramson, Ed. New York: Josiah Macy, Jr. Foundation, 1951. 200 pp. \$3.00.

*Space-Time-Matter*. 1st Amer. ptg. of 4th ed. Hermann Weyl; trans. by Henry L. Brose. New York: Dover, 1951. 330 pp. \$3.95.

*Man and the Animal World*. Bernal R. Weimer. New York: Wiley; London: Chapman & Hall, 1951. 569 pp. \$5.00.

*Linear Polymers*. Elizabeth M. Frith and R. F. Tuckett. London-New York: Longmans, Green, 1951. 355 pp. \$3.50.

*Igneous and Metamorphic Petrology*. Francis J. Turner and Jean Verhoogen. New York: McGraw-Hill, 1951. 602 pp. \$9.00.

*Genetics: A Survey of the Principles of Heredity*. A. M. Winchester; Bentley Glass, Ed. Boston: Houghton Mifflin, 1951. 371 pp. \$5.00.

*Principles and Practice of Obstetrics* (DeLee's). 10th ed. J. P. Greenhill. Philadelphia-London: Saunders, 1951. 1,020 pp. \$12.00.

*Insect Physiology*. 4th ed. V. B. Wigglesworth. London: Methuen; New York: Wiley, 1950. 134 pp. \$1.25.

*Eyes in Industry: A Comprehensive Book on Eyesight Written for Industrial Workers*. Dorothy Adams Campbell, W. J. B. Riddell, and Sir Arthur Salusbury MacNalty. London-New York: Longmans, Green, 1951. 234 pp. \$6.50.

*Connective Tissue*. Transactions of the First Conference, April 24-25, 1950, New York. Charles Ragan, Ed. New York: Josiah Macy, Jr. Foundation, 1951. 164 pp. \$3.25.

*Analytic Geometry*. 2nd ed. John W. Cell. New York: Wiley; London: Chapman & Hall, 1951. 326 pp. \$3.75.

*Nerve Impulse*. Transactions of the First Conference, March 2-3, 1950, New York. David Nachmansohn, Ed. New York: Josiah Macy, Jr. Foundation, 1951. 159 pp. \$3.00.

*Gall Midges of Economic Importance: Gall Midges of Trees*, Vol. V. H. F. Barnes. London: Crosby Lockwood, 1951. 270 pp. 15 s.

*Elementary Principles of Statistics*. A. C. Rosander. New York-London: Van Nostrand, 1951. 693 pp. \$6.00.

*Advances in Electronics*, Vol. III. L. Marton, Ed. New York: Academic Press, 1951. 357 pp. \$7.50.

*The Chromosomes*. 4th ed. M. J. D. White. London: Methuen; New York: Wiley, 1950. 124 pp. \$1.50.

*Symbolic Realization: A New Method of Psychotherapy Applied to a Case of Schizophrenia*. M. A. Sechehaye; trans. from French by Barbrö Würsten and Helmut Würsten. New York: International Univ. Press, 1951. 184 pp. \$3.25.

*Clinical Laboratory Methods*. 4th ed. W. E. Bray. St. Louis, Mo.: Mosby, 1951. 614 pp. \$7.25.

*Hans Driesch: Persönlichkeit und Bedeutung für Biologie und Philosophie von heute*. Aloys Wezel, Ed. Basel: Ernst Reinhardt, 1951. 221 pp. Sw. fr. 11.- paper; 13.50 cloth.

*Lebenserinnerungen*. Hans Driesch. Basel: Ernst Reinhardt, 1951. 311 pp. Sw. fr. 11.-.

*Modern Interferometers*. C. Candler. London: Hilger & Watts; Boston: Jarrell Ash, 1951. 502 pp. \$9.75.

*Nutrition and Alcoholism*. Roger J. Williams. Norman: Univ. Oklahoma Press, 1951. 82 pp. \$2.00.

*Faune de France: Cumacées*, Vol. 54. Louis Fage. Paris, France: Paul Lechevalier, 1951. 136 pp. 1,200 fr.

*De Bare's sprekende Toradjas van Midden-Celebes (De Oost-Toradjas)*, Vol. I. Rev. 2nd ed. N. Adriani and Alb. C. Kruyt. Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 1950. 478 pp.

*The Beginnings of Diplomacy: A Sociological Study of Intertribal and International Relations*. Ragnar Numelin. New York: Philosophical Library, 1950. 372 pp.

*Allergy: Facts and Fancies*. Samuel M. Feinberg. New York: Harper, 1951. 173 pp. \$2.50.

## News and Notes

### The First Ohio Intercollegiate Geology Field Trip

C. N. Savage

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THE Kent State Geological Society successfully operated the first Ohio intercollegiate geology field trip on May 5. The society members, composed of geology majors and other interested students, patterned the trip after the annual New England intercollegiate excursions, which have been functioning for more than 40 years.

Nearly 100 practicing geologists, professors, students (graduate and undergraduate), and interested laymen visited the Cuyahoga Gorge Park northeast of Akron, Ohio, where rocks and structures of Pennsylvanian and Mississippian age were examined and discussed. The Mississippian-Devonian rock section along Chippewa Creek east of Brecksville, Ohio, was also studied. Student members of the geological society led the trip after distributing their own mimeographed 23-page résumé, including maps, diagrams, a plate of fossil types, and well log. Subject matter reviewed included glacial geology, geomorphology, paleontology, and economic geology of the lower Cuyahoga valley region.

Students and faculty members from the following institutions were participants: Western Reserve, Ohio, Ohio Wesleyan, Bowling Green, Kent State, and Ohio State. Several representatives were present from the Kirtland Geology Club, Ohio Division of Water Resources, U. S. Geological Survey, Cleveland Museum of Natural History, Akron *Beacon Journal*, and the Kent State Geological Society.

It has been suggested that Section C (geology) of the Ohio Academy of Science sponsor an intercollegiate trip each year. Several academy members favor the substitution of an intercollegiate trip for the recently initiated fall Academy of Science geology field trip. If this is done, then it is strongly recommended that the participation of students and laymen continue to be encouraged, for this was the primary purpose of the intercollegiate excursion. Then the spring field trip, operated annually by the academy's Section C, might maintain a more professional aspect.

### Association of Geology Teachers

Sidney E. White

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THE first annual meeting of the Association of Geology Teachers, Eastern Section, was held at Easton, Pa., April 20-21. The Department of Geology

at Lafayette College, under the guidance of James L. Dyson, was host for the occasion. The first day of the meeting was devoted to the presentation and discussion of the following papers:

Successful Geology Teaching and the Association of Geology Teachers, Earl T. Apfel, Syracuse University  
Status of Secondary Education Teaching in Geology, Ralph E. Digman, Harpur College  
Geology Instruction at British Universities, Gerald M. Friedman, University of Cincinnati  
Cooperation between the Association of Geology Teachers and the American Geological Institute, David M. DeLo, Executive Director, American Geological Institute  
Training Geologists and the Geologists at Work (colored movies), Geology Staff, Franklin and Marshall College  
Problems of Teaching Geology in the Urban College, Robert L. Bates, Rutgers University  
Geologic Instruction in Pennsylvania, Bradford Willard, Lehigh University  
A Review Chart for Historical Geology, Lawrence Whitcomb, Lehigh University  
Trends in Chemistry, Mathematics, and Physics Requirements for Geology Majors, Hugh R. Gault, Lehigh University  
The Honors Major as an Aid in Selecting Candidates for Professional Training in Geology, Paul J. Storm, University of Pennsylvania  
Geology and General Education, E. P. Thatcher, Washington College  
Upgrading the Geological Slide Library, A. Scott Warthin, Jr., Vassar College

Emphasis was placed on the need for education of the general public in the value of geology, and upon the preparation of students so that they will be able to think independently about geology. The necessity of teaching more earth science in the secondary schools was demonstrated. Some of the papers will be published in the *Journal of Geologic Education*. During the business meeting, held on April 21, an interim constitution and bylaws for the new section were adopted.

The section was organized under the leadership of Ralph Digman, of Harpur College, in November 1950. He has served as president since its founding, and much of the success of this meeting was the result of his planning and enthusiasm. New officers elected for the coming year are: President, Chilton E. Prouty, University of Pittsburgh; vice president, A. Scott Warthin, Jr., Vassar College; secretary-treasurer, Milton T. Heald, West Virginia University; editor, Lawrence Whitcomb, Lehigh University.

### Scientists in the News

James Whitman Agna, of Cincinnati, and David Hyman Feldman, of Chicago, have joined the ECA Specialized Technical and Economic Mission in Burma. The mission, undertaken at the request of the Burmese government, has been functioning since October 1950, with Leroy R. Allen, of the USPHS, as chief of its

public health division. The medical personnel attached to the mission now numbers 15.

**Phyllis F. Bartelme**, research consultant in psychology, has joined the professional staff of the National Society for Crippled Children and Adults as New York field representative and consultant in psychology. She will interpret specific needs of crippled children and adults to other national organizations in the health and welfare fields. She will also counsel and advise state and local Easter Seal affiliates of the national society in the development of psychological services for crippled children. Dr. Bartelme has been research consultant for the Institute of Welfare Research of the Community Service Society in New York.

**George W. Beadle**, chairman of the Division of Biology at Caltech, gave the first R. E. Dyer lecture at the National Naval Medical Center, on "Genetic Control of Metabolism." It opened the two-day program marking the cornerstone ceremonies for the new Public Health Service Clinical Center.

**C. R. Bonnell**, of the School of Mines and Metallurgy, University of Missouri, has been appointed research engineer at the Minneapolis-Honeywell Company.

**R. A. Brink** and **James F. Crow**, Department of Genetics, University of Wisconsin, have been elected managing editor and associate managing editor of *Genetics*. They are to succeed **Curt Stern**.

**L. Virginia Carlton**, of Northwestern State College, has been appointed head of the Department of Mathematics of Wesleyan College.

**H. V. Churchill**, chief of the Analytical Division of Aluminum Company of America's Research Laboratories in New Kensington, has retired from active service. He will be succeeded by his son, **J. R. Churchill**, who has been his assistant since December 1944. H. V. Churchill has been affiliated with Alcoa since 1919. J. R. Churchill began his career with Alcoa in the analytical division of the New Kensington Research Laboratories in 1929. In 1941 he became chief spectrographer, and in 1944 assistant chief of the analytical chemistry division.

**Donald S. Clark** and **Pol Duwez**, associate professors of mechanical engineering at Caltech, have received the Charles B. Dudley Medal, highest award of the American Society for Testing Materials. Presented at the annual meeting of the society in Atlantic City, the award was established in 1926 in recognition of meritorious contributions to research in engineering materials. Drs. Clark and Duwez wrote on "The Influence of Strain Rate on some Tensile Properties of Steel."

**Cleo F. Craig** has been elected president of American Telephone and Telegraph Company succeeding **Leroy A. Wilson**, who died on June 28 after a long period of illness and ill health. Mr. Craig, financial

vice president, had been named acting president two days before Mr. Wilson's death.

**Edward F. Degering**, professor of chemistry at Purdue, and a member of the faculty since 1930, will resign as of August 31. Mr. Degering, who is secretary of AAAS Section C, has been on leave of absence for two years at the Armour Research Foundation and at the Miner Laboratories. He has accepted a position as research manager with the Buckman Laboratories, of Memphis.

The Electrochemical Society has awarded **Paul Delahay**, of Louisiana State University, the Turner Book Prize for 1951, donated by Francis M. Turner, vice president of Reinhold Publishing Corporation. The award is made annually for the best paper submitted by a young electrochemist.

At the annual meeting of the board of the Frozen Food Institute, **Herman W. Dorn** was elected president for a term of three years. Dr. Dorn is a former member of the faculty of the University of Iowa and director of research for Irwin, Neisler & Company, Decatur, Ill., from which he recently resigned to open his own food and drug consulting offices in Decatur. From 1946 to 1950 he was associate editor of *Food Technology*.

**John Field** has been named head of the National Science Foundation's Division of Biological Sciences. Dr. Field, on leave of absence as chairman of the Department of Physiology of the University of California Medical School at Los Angeles, has been serving as head of the Biology Branch of the Office of Naval Research.

**H. Munro Fox**, professor of zoology in the University of London and president of the International Union of Biological Sciences, will be in Washington October 15-21 to attend a meeting of the Executive Committee of the International Council of Scientific Unions. After the meeting, he will visit university research laboratories and deliver certain lectures in California. Dr. Fox has been editor of *Biological Reviews* for the past 25 years.

**Christine Gilbert**, senior demonstrator in anatomy at the University of Witwatersrand, and Carnegie fellow in embryology, is the guest of the Department of Anatomy in the Tissue Culture Laboratory of the University of Texas Medical Branch during July. Dr. Gilbert is studying the influence of mutagenic factors in nervous system development. After leaving Galveston, she will return to Baltimore, where she has been working with **George W. Corner**, to complete her studies before returning to South Africa.

The social effects of modern technological developments in agriculture and industry will be the focus of a year's study in the Andean valley of Callejón de Huaylas, Peru, by **Allan R. Holmberg** and several graduate students from the Department of Sociology and Anthropology at Cornell. Professor Holmberg, who has carried out studies in this region since 1948,

plans to begin an experiment in health, nutrition, agriculture, and education on the Indian hacienda of Vicos, a subsistence agricultural community. The Cornell anthropologists will work with the Peruvian ministries of health, agriculture, and education, and with social scientists of the Institute of Ethnology of the University of San Marcos.

**Frank M. Huennkens**, of the Institute for Enzyme Research, University of Wisconsin, and **Walter B. Dandliker**, of the University Laboratory for Physical Chemistry Related to Medicine and Public Health of Harvard, have been appointed assistant professors in the Department of Biochemistry, University of Washington.

**Ruth Johnson**, first nurse assigned to Iran under the Point IV Program, will join the health mission in Teheran as chief nurse adviser. Miss Johnson will assist in the development of public health nursing, particularly in the rural areas. She will work with **Emil E. Palmquist** and **Frederick F. Aldridge**, who are in the field as deputy technical assistant director and chief sanitary engineer of the Point IV Mission. Miss Johnson served in Japan for two years with the 8th Army Civil Affairs Program, and in Egypt, Greece, and China from 1944 to 1947, assigned to Unrra.

**Edward I. Kotok**, assistant chief in charge of research, has retired after 40 years with the Forest Service. He has accepted a position with FAO as head of a Chilean mission on forestry, agriculture, and fisheries, with headquarters in Santiago, Chile.

**Edwin M. McMillan**, professor of physics at the University of California, has received the Research Corporation Scientific Award for 1950. Dr. McMillan is a co-discoverer of neptunium and plutonium. In 1945 he developed independently the "theory of phase stability," which has made possible the construction of the synchrotron, the synchrocyclotron, and the bevatron.

**Walter J. Meek**, emeritus professor of physiology and associate dean of the University of Wisconsin School of Medicine, has accepted a position as lecturer in physiology at the University of Texas Medical Branch, Galveston. Professor Meek plans to spend a week or two in each spring semester at Galveston for a series of conferences and demonstrations in physiology.

To help them in their study of tropical invertebrate animals in Panama this summer, **Lorus J.** and **Margery J. Milne**, of the University of New Hampshire, have received a grant from the American Philosophical Society. They will spend three months studying the light-sensitive structures of the animals they will find in the vicinity of the Barro Colorado Island biological laboratory at Gatun Lake. They have also received a grant from the American Academy of Arts and Sciences to help finance their trip.

**S. M. Naude**, formerly of Stellenbosch University,

and **H. L. de Waal**, of the University of Pretoria, have won the Havenga prizes for physics, mathematics, and chemistry. Professor Naude was awarded the prize in physics and mathematics "for his important pioneering in spectroscopic analysis and for his furthering of this science in general while at Stellenbosch and as director of the National Physics Laboratory of the Scientific and Industrial Council." Professor de Waal won the prize in chemistry "because he showed it possible for a professor at a South African University to instigate planned and fruitful progress in the field of chemistry and to bring about a wider field of systematic research in the poisons in South African flora."

**George P. Pearce**, an electrical and mechanical engineer with the Office of Engineering and Construction of the Santa Fe Operations Office, AEC, has retired at the age of 70. He has been employed by the government for 17 years. Mr. Pearce will move to Albuquerque, where he will work for Holmes & Narver, an engineering firm doing work at Sandia Base.

**William H. Peterson**, of the University of Wisconsin, will be a Fulbright lecturer at the University of Melbourne in Australia this summer. Professor Peterson will carry some of the university's special cultures of penicillin and citric acid to aid research in Melbourne. A member of the University of Wisconsin faculty since 1909, Professor Peterson was scheduled to retire last month, but he expects to return to his research laboratories on the campus after his Fulbright lectureship.

**Gösta Säfllund** will lead the archaeological expedition that was being planned by Axel W. Persson at the time of his death. After his appointment to a chair of classic archaeology at Upsala University in 1924, Professor Persson conducted several Swedish expeditions to Greece and Asia Minor. He was the discoverer of the rich finds in the royal tomb at Dendra, and of the Temple of Zeus at Labranda, Turkey, dating back to 350 B. C.

**John A. Trautman** has been appointed director of the 500-bed clinical center for medical research nearing completion in Bethesda, Md. At present he is in charge of the marine hospital at Staten Island, N. Y. Dr. Trautman assumed his new post on July 1. Completion of the center is scheduled for late in 1952. Two other appointments are expected: **Charles Davidson** as chief of clinical research and **Ralph Knutti** as chief of extramural activities, both in the National Institute of Arthritis and Metabolic Diseases. At present, Dr. Davidson is associate director of Thorndyke Memorial Laboratory at Boston City Hospital, and Dr. Knutti is on the medical faculty of the University of Southern California.

**Alfred Weissler** has joined the Research Branch of the office of the Chief of Ordnance, the Pentagon, to work in a new program of sponsored basic research in ordnance. He was previously in charge of chemical ultrasonics research at the Naval Research Laboratory.



## Education

Canada's annual **Eastern Arctic Patrol** will include an eye survey of a large number of Eskimos in cooperation with the Canadian National Institute for the Blind. J. A. and Mrs. Houston, who are collecting Eskimo sculptures and other items of native handicraft, will joint the patrol ship, *C. D. Howe*, at Cape Dorset. A Dominion Observatory survey party will determine the strength and direction of the earth's magnetic field at each port of call, collecting data to revise magnetic maps and to provide more precise charts of northern waters. J. Cantley and Alex Stevenson, of the Arctic Services of the Department of Resources and Development, will be in charge of the 10,000-mile, four-month expedition.

**Caltech's** \$1,250,000 synchrotron is nearing the end of a preliminary construction stage known as "phase zero," during which tests will be made to solve mechanical and electrical problems before final assembly. In "phase one," which is expected to be reached by next winter, the machine will be operated at half-capacity, which will bring the equipment to "phase two," in which the peak energy will be a billion volts.

**Coker College** is constructing a three-story science building to be named the William Chambers Coker Science Building in honor of the emeritus Kenan professor of botany at the University of North Carolina. Upon its completion this fall, it will provide space for the Departments of Biology, Chemistry, Physics, and Mathematics.

Social scientists and housing experts at **Cornell** are engaged in a two-year project sponsored by the Russell Sage Foundation to develop guides for building houses to suit the habits of different kinds of families. Supervising the project are Thomas W. Mackesey and Glenn H. Beyer, who will work with James E. Montgomery and Frank Weise.

The **International Research Centre for Chemical Microbiology** was opened in Rome last month with a symposium on "Bacterial Growth and its Inhibition," at which S. A. Waksman, M. Demerec, M. J. Johnson, P. Regna, and E. Weber represented the U. S. E. B. Chain, of the Istituto Superiore de Sanità, will be director of the new center, which will provide facilities for basic research on antibiotics.

**Marine Biological Laboratory**, Woods Hole, Mass., opened its Friday evening lecture series June 29 with an address by Douglas A. Marsland. The program ends on August 31. Other speakers: Severo Ochoa, Ralph W. Gerard, Balduin Lucké, Hans Borei, Denis L. Fox, Nelson T. Spratt, Jr., T. H. Waterman, R. W. G. Wyckoff, and Horace W. Stunkard.

The **Maryland Department of Research and Education** will carry on a study of the hydrography and biology of the Chincoteague Bay area, designed primarily to gather data on factors governing oyster production.

The **Chesapeake Biological Laboratory** and the **Chesapeake Bay Institute** plan to make an intensive study of the St. Mary's River during the oyster spawning and setting season this summer. Biologists of the Virginia Fisheries Laboratories and of the U. S. Fish and Wildlife Service will cooperate. A study is also being made on ship worms, which cause great destruction of wharves and hulls of wooden ships. R. V. Truitt is conducting this investigation at a series of 12 stations in Chesapeake Bay.

The **National Geographic Society-Royal Ontario Museum** expedition, under the leadership of Victor Ben Meen, has left for Chubb Crater, discovered in northern Quebec last July. Mine detectors and magnetometers will be used in an effort to discover the origin of the two-mile wide crater between Hudson and Ungava bays. The lake in the center will be plumbed to determine its depth, and test borings made of the bottom. A thorough topographic survey of the area will also be made.

At its annual meeting in June the Council of the **Oak Ridge Institute of Nuclear Studies** elected three new sponsors: Florida State University and the Universities of Maryland and Puerto Rico, bringing the total number of sponsoring institutions to 29. William V. Houston, of Rice Institute, was elected to a three-year term on the Board of Directors, succeeding Harold W. Stoke. Paul M. Gross was re-elected president of the Institute, and Jesse W. Beams, vice president. Pete Kyle McCarter was elected vice chairman of the council, succeeding George H. Boyd.

The full-time clinical teaching staff of the **University of Texas Medical Branch** has been increased by the following appointments: M. Allen Forbes (dermatology and syphilology); Milton Hejtmancik and Harry Levine (internal medicine); Irving W. Cohen (neurology and psychiatry); Robert L. Hargrave (oncology); John M. Childers (surgical pathology); Roger Leinke (pediatrics); and Caroline Rowe (radiology). A Tissue Metabolism Laboratory, recently established under the direction of Wiktor W. Nowinski, will be devoted to clinical research in the treatment of burns.

Visiting professors at **Stanford University** this summer are George E. Uhlenbeck, co-discoverer of the spin of the electron, who is lecturing on statistical mechanics, and Abraham Pais, Dutch-born theoretical physicist, who has been teaching in the U. S. for the past four years, mainly at the Institute for Advanced Study, Princeton.

## Grants and Fellowships

Because of the congestion of applications the **American Board of Nutrition** has announced an extension of time from July 1, 1951, to February 29, 1952, during which period candidates may be certified on the basis of their training and experience, without examination. After February 29 all applicants will be required to submit to examination.



The Ford Foundation grant of \$300,000 made to Harvard last year will be divided between a Medical School five-year study of the physiological and psychological effects of adrenal hormones, and a project for research and training in human relations to be carried out by the Graduate School of Business Administration.

Hahnemann Medical College and Hospital has received a grant from the Office of Naval Research for the investigation and perfection of techniques for transplantation of organs, and from Smith, Kline & French Laboratories for research on chemotherapeutic agents.

The third William H. Park Fellowship has been awarded to James Wilky Lynn, Jr., GI postgraduate fellow in pediatrics at the University of Rochester School of Medicine, for a year of work in virus diseases. Inquiries regarding this new fellowship may be addressed to Timothy J. Healy, 521 Fifth Ave., New York 17.

Sharp & Dohme, Inc., has placed \$50,000 in a special fund for grants to "outstanding university scientists for the advancement of fundamental research in the fields of biology, microbiology, and chemistry." Two grants of \$10,000 each have been made from the new fund to W. W. Swingle, of Princeton, and Stanley J. Sarnoff, of Harvard.

The Upjohn Company will support studies at the University of Illinois College of Medicine on intravenous gelatin, under C. W. Vermeulen. Max S. Sadove will study the screening and investigation of new anesthetic drugs under a grant from Winthrop-Stearns, Inc.

## Meetings and Elections

Alloy Casting Institute has elected Warden F. Wilson president and H. T. Harrison vice president. E. A. Schoefer was re-elected secretary-treasurer, and G. A. Baker and J. S. Wooters were elected to three-year terms as members of the Board of Directors.

At its meeting in Washington, D. C., the American Astronomical Society elected the following officers: C. D. Shane, vice president; C. M. Huffer, secretary; J. J. Nassau, treasurer; M. Schwarzschild, M. L. Humason, and S. Chandrasekhar, counselors. A. H. Joy will serve another year as president.

The American Society for Experimental Pathology has elected the following officers, who took office on July 1: F. S. Robscheit-Robbins, president; S. C. Madden, vice president; R. L. Holman, secretary-treasurer; D. M. Angevine and C. C. Erickson, counselors. The 1952 annual meeting will be held in New York City April 14-18.

John Chipman, of MIT, will serve as president of the American Society for Metals for 1951-52. Ralph L. Wilson will be vice president, and Ralph L. Dowdell

treasurer. George A. Roberts and J. B. Johnson were elected to the nine-member Board of Trustees.

For information regarding the sixth **Calorimetry Conference**, to be held in the Pupin Physics Laboratory of Columbia University, September 5, write to D. R. Stull, chairman, Dow Chemical Co., Midland, Mich. The tentative program lists 12 addresses by experts from government, university, and industrial laboratories.

A **Conference on Interfacial Phenomena and Nucleation** will be held August 21-25 at Boston University under the sponsorship of the university and the Geophysical Research Directorate of the Air Force Cambridge Research Laboratories. Canadian, English, German, Swedish, and U. S. scientists will discuss physical adsorption, thermodynamic and statistical theories of surface tension, and the kinetics of phase transitions.

Six European physicists will conduct a symposium at Oak Ridge, Tenn., September 13-14 on the general subject "**Nuclear Physics in Europe.**" Symposium leaders will be: E. Amaldi, University of Rome; J. Rotblatt, University of London; R. I. Peierls, University of Birmingham; S. D. Devons, Imperial College of Science and Technology, London; P. Huber, University of Basel; and J. Mattauch, University of Bern. The symposium is being given under the joint sponsorship of the Oak Ridge National Laboratory and the Oak Ridge Institute of Nuclear Studies. All interested physicists and others are invited to attend. Additional information may be obtained from the University Relations Division, P. O. Box 117, Oak Ridge, Tenn.

An international symposium on the **Physiological Role of Vitamins and Trace Elements**, in honor of Elmer V. McCollum, discoverer of vitamins A and D, will be held at The Johns Hopkins University, September 10-11, under the sponsorship of the School of Hygiene and Public Health and the Robert Gould Research Foundation of Cincinnati. Dr. McCollum is professor emeritus of biochemistry and is still active in the field of nutritional research.

The **Society for the Study of Development and Growth** will hold a symposium at Smith College August 30-September 3, in which Kenneth V. Thimann, W. E. Heston, N. H. Horowitz, M. Chevrement, R. O. Erickson, and J. F. Holtfreter will participate. George S. Avery, Jr., L. C. Dunn, E. J. Boell, Philip R. White, and Viktor Hamburger will be presiding officers, and A. F. Blakeslee will give the welcoming address.

Morton A. Seidenfeld, director of psychological services of the National Foundation for Infantile Paralysis, will be one of the speakers at the second **International Poliomyelitis Conference** in Copenhagen, September 3-7. His subject will be "Psychological Aspects of Poliomyelitis." Dr. Seidenfeld is honorary president of the Society for Military Clinical Psychologists.

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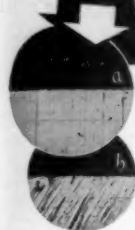
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## Meetings & Conferences

- Aug. 6-12. British Association for the Advancement of Science. Edinburgh.
- Aug. 7-9. American Meteorological Society. State College, Pa.
- Aug. 13-Sept. 7. Canadian Mathematical Congress (Summer Seminar). Dalhousie University, Halifax.
- Aug. 20-23. American Institute of Electrical Engineers (Pacific). Multnomah Hotel, Portland, Ore.
- Aug. 20-23. National Council of Teachers of Mathematics (Annual). St. Olaf College, Northfield, Minn.
- Aug. 21-Sept. 1. International Union of Geodesy and Geophysics. Brussels.
- Aug. 22-25. Plant Science Seminar. University of Buffalo School of Pharmacy, Buffalo, N. Y.
- Aug. 22-Sept. 11. International Congress on Refrigeration. London.
- Aug. 23-30. Institute for Teachers of Mathematics. Connecticut College, New London.
- Aug. 26-31. American Pharmaceutical Association. Statler Hotel, Buffalo.
- Aug. 27-29. American Association of Jesuit Scientists, Eastern States Division (Annual). Boston College, Chestnut Hill, Mass.
- Aug. 27-30. Illuminating Engineering Society. Washington, D. C.
- Aug. 27-30. Social Work Institute, including discussions on the Problem of Old Age. Valparaiso University, Valparaiso, Ind.
- Aug. 27-31. American Society of Agronomy. Pennsylvania State College, State College.
- Aug. 27-31. Soil Science Society of America. Pennsylvania State College, State College.
- Aug. 27-Sept. 7. Symposium on "The Role of Engineering in Nuclear Energy." Oak Ridge, Tenn.
- Aug. 31-Sept. 5. American Psychological Association. Hotel Sherman, Chicago.
- Sept. 1-3. Astronomical League. University of North Carolina, Chapel Hill.
- Sept. 3-4. Mathematical Association of America (Summer). University of Minnesota, Minneapolis.
- Sept. 3-7. American Chemical Society (Annual). New York.
- Sept. 4-7. American Mathematical Society (Summer). University of Minnesota, Minneapolis.
- Sept. 5. Calorimetry Conference. Pupin Physics Laboratory, Columbia University, New York.
- Sept. 5-7. Mycological Society of America. University of Minnesota, Minneapolis.
- Sept. 7-8. World Confederation for Physical Therapy. Copenhagen.
- Sept. 8-9. International Union of Pure and Applied Chemistry. New York.
- Sept. 8-12. Ecological Society of America. University of Minnesota, Minneapolis.
- Sept. 8-15. American Occupational Therapy Association (Annual). New Castle, N. H.
- Sept. 9-14. International Gerontological Congress. Hotel Jefferson, St. Louis.
- Sept. 9-14. International Society for the Welfare of Cripples (World Congress). Stockholm.
- Sept. 10-12. American Institute of Biological Sciences (Annual). University of Minnesota, Minneapolis.
- Sept. 10-13. International Congress of Pure and Applied Chemistry. New York.



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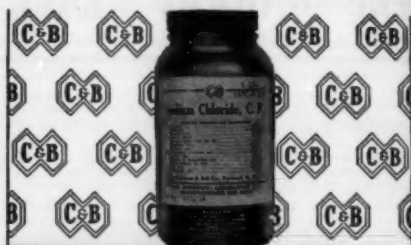
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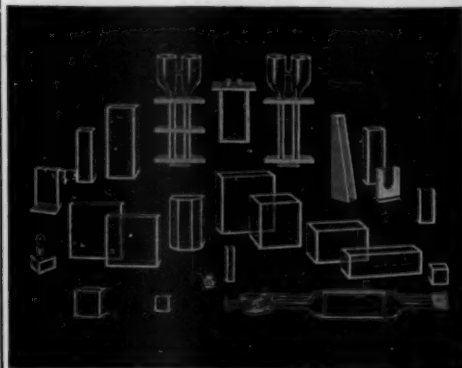
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*Hotel Astor  
New York City  
March 4, 1951*

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*National Academy of Sciences  
Schenectady, New York  
October 10, 1950*

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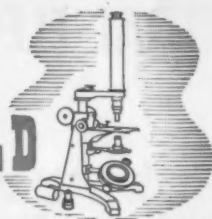
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